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WHITTAKER CORPORATION

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

SANTA CLARITA VALLEY WATER AGENCY, Plaintiffs, vs. WHITTAKER CORPORATION and DOES 1-10, inclusive Defendants. WHITTAKER CORPORATION, Third-Party Plaintiff, vs. KEYSOR-CENTURY CORP., a California Corporation; and SAUGUS INDUSTRIAL CENTER, LLC, a Delaware Limited Liability Company, Third-Party Defendants.	Case No. 2:18-CV-6825-SB (RAOx) *Assigned to Hon. Stanley Blumenfeld, Jr.* **DECLARATION OF GARY HOKKANEN IN SUPPORT OF DEFENDANT WHITTAKER CORPORATION'S OPPOSITION TO PLAINTIFF SANTA CLARITA VALLEY WATER AGENCY'S MOTION FOR SUMMARY JUDGMENT** Date: January 8, 2021 Time: 8:30 a.m. Dept.: 6C Action Filed: August 8, 2018 Status Conf.: January 19, 2021

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I, Gary Hokkanen, declare as follows:

1. I am a Principal Hydrogeologist and Vice President of EKI Environment & Water. I have 40 years of experience in the investigation and remediation of contaminated property, with extensive experience assessing volatile organic compound (VOC) contamination in soil and groundwater. I received my B.S. in Civil Engineering from the University of Minnesota in 1980 and an M.S. in Hydrogeology from the University of Waterloo (Ontario, Canada) in 1984. Prior to my employment at EKI, I was employed with the U.S. Environmental Protection Agency (1980-82), EWA, Inc. (1984-85); Barr Engineering Company (1985-89); Geraghty & Miller, Inc. (1989-94); Geomatrix Consultants (1994-2004), Hokkanen Environmental (2004-14), and Farallon Consulting (2014-19). I have testified in several litigation matters.

2. I was retained by Whittaker Corporation (Whittaker) to evaluate the potential relationship of the Whittaker Bermite Site (Bermite Site), located at 22116 West Soledad Canyon Road in Santa Clarita, California, and the detection of volatile organic compounds (VOCs) in Santa Clarita Valley Water Agency (Water Agency) groundwater production wells.

3. I am providing this Declaration in support of Whittaker's opposition to Santa Clarita Valley Water Agency's Motion for Summary Judgement. I have previously prepared an Expert Report for this matter, relevant sections of my Expert Report are attached as Exhibit A. These portions are true and correct and accurately reflect opinions that I hold in this matter.

4. This Declaration is based upon my training and experience and my review of environmental reports prepared by consultants for Whittaker and the Water Agency and other parties, expert reports, deposition testimony, documents

produced and other materials which I consider to be reliable and appropriate bases for the opinions expressed here.

Summary

5. My opinions regarding the relationship between the Bermite Site and the detection of VOCs in the Water Agency's groundwater production wells are as follows:

a. The primary contaminants released on the Bermite Site were perchlorate and VOCs.

b. Perchlorate and VOCs have different properties and behave differently when released to the environment, including migration in surface water and groundwater.

c. The investigations at the Bermite Site determined that perchlorate and VOCs were generally released from the same source areas.

d. Perchlorate and VOCs released to the subsurface from the source areas on the Bermite Site followed the same migration pathway in the unsaturated zone and in groundwater.

e. Due to their different properties, perchlorate and VOCs have different migration rates in groundwater and releases of perchlorate from the source areas have migrated faster and further than VOCs.

f. Perchlorate migrated from source areas on the Bermite Site in surface water and VOCs did not.

g. Although perchlorate has impacted Water Agency groundwater production wells downgradient of the Bermite Site, based on the differences in migration rates and supported by the water quality data, VOCs from the Bermite Site have not migrated to the Water Agency's groundwater production wells and the Bermite Site is not a source of the VOC detections in the wells at issue.

h. VOCs from the Bermite Site have not impacted the Water Agency's groundwater production wells Saugus 1, Saugus 2, V-201 and V-205.

i. VOCs have contaminated groundwater at the Saugus Industrial Center (SIC) Site and there is a plausible pathway for groundwater from the SIC Site to migrate to Saugus 1 and Saugus 2 due to the unique geology of the SIC Site and its proximity to the groundwater production wells.

j. There are other known sources and potential sources that are contributing VOCs to the Water Agency's groundwater production wells.

k. The most likely source of VOC contamination for V-201 and V-205 is upgradient VOC contamination in the vicinity of the Mall wells that is being drawn to V-201 and V-205 by the pumping of V-201. The Bermite Site is not the source of the VOCs found in the vicinity of the Mall wells.

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l. Based on the available data, other previously unidentified sources could be contributing VOCs in the Water Agency's distribution system.

Background

6. The Santa Clarita Valley Water Agency supplies water to the Santa Clarita Valley. The Water Agency obtains water from several sources, including the State Water Project (SWP), groundwater, and recycled water. Groundwater is obtained from groundwater production wells in two aquifers, the Alluvium, and the Saugus Formation. These include 37 Alluvium wells and 10 Saugus Formation wells.

7. In 1997 perchlorate was detected in four of the Water Agency's Saugus Formation groundwater production wells (Saugus 1, Saugus 2, NC-11, and V-157). Perchlorate was also detected in an Alluvium well (Stadium Well) in 2002. These five groundwater production wells were shut down after the detection of perchlorate.

8. Perchlorate has subsequently been detected in one additional Alluvium well (Q-2) and two Saugus Formation wells (V-201 and V-205).

9. The Saugus 1 and Saugus 2 groundwater production wells were returned to service in 2010 after completion of a Perchlorate Treatment Plant. The Perchlorate Treatment Plant removes the perchlorate from the water from Saugus 1 and Saugus 2. The treated water is piped into the Water Agency distribution system.

10. Groundwater production wells V-157 and the Stadium Well were sealed. V-201 and V-205 are currently not producing groundwater to be served to customers.

11. Several VOCs, including tetrachloroethylene (PCE) and trichloroethylene (TCE), were detected in Saugus 1 and Saugus 2 when they were returned to service in 2010. PCE and TCE concentrations in Saugus 1 and Saugus 2 are below the Maximum Contaminant Level (MCL) of 5.0 micrograms per liter (µg/L). PCE and TCE have been detected in groundwater production wells V-201 and V-205 below the MCL. An MCL is the maximum allowable amount of a substance that is allowed in public water systems under the Safe Drinking Water Act.

12. Saugus 1 and Saugus 2 are located northwest and downgradient (in the direction of groundwater flow) from the Bermite Site (Figure 1). Groundwater production wells V-201 and V-205 are west of Saugus 1 and Saugus 2 and further downgradient from the Bermite Site. V-201 is located approximately ¾ mile (3,900 feet) west of Saugus 1. V-205 is located over a mile west of Saugus, approximately 6,200 feet.

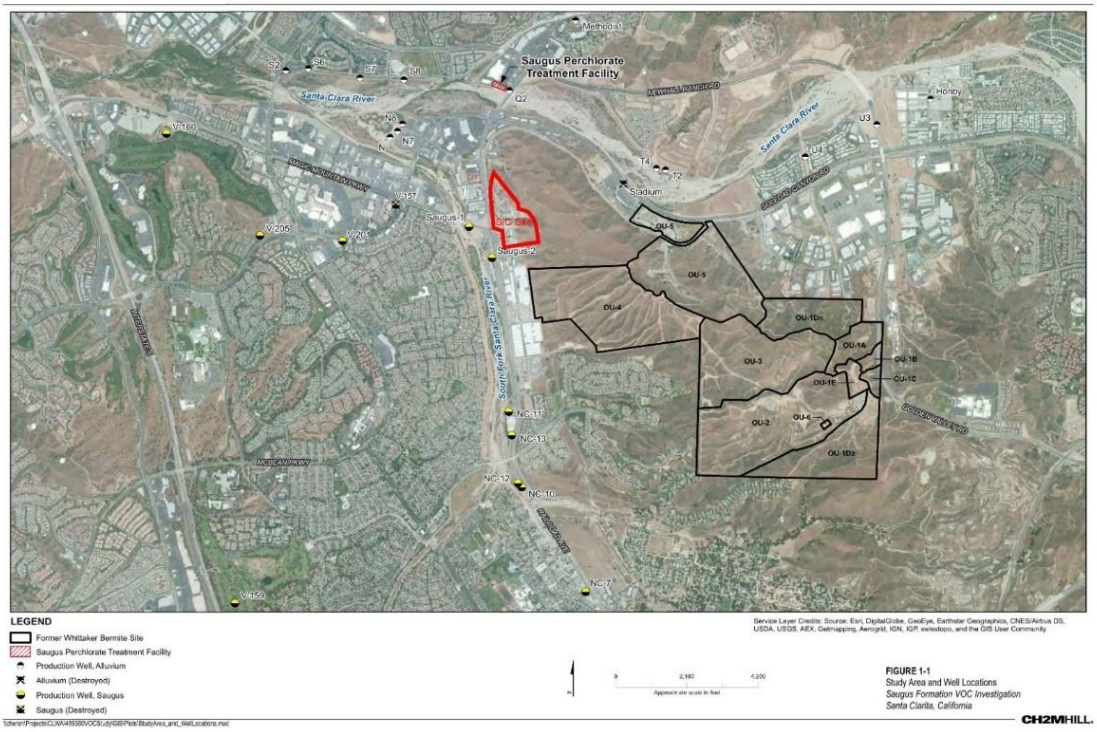

FIGURE 1

Bermite Site

13. The Bermite Site is a former manufacturing facility located at 22116 West Soledad Canyon Road in Santa Clarita, California and consists of approximately 996 acres. It is located east and generally upgradient of Saugus 1, Saugus 2, V-201, and V-205 groundwater production wells (Figure 1). The property was used for explosives and munitions manufacturing from 1934 to 1987. The manufacture of these products involved the use of materials that contained perchlorate, primarily propellants. In addition, chlorinated solvents were reportedly used for degreasing and cleaning activities. Soil, groundwater, and soil gas were impacted by perchlorate and VOCs, including PCE and TCE, because of the manufacturing activities at the Bermite Site.

Perchlorate and VOCs

14. Perchlorate is a non-volatile chemical that is highly soluble in water.[1] It is relatively stable and mobile when released to surface water and groundwater. It moves at approximately the same rate as groundwater since it does not sorb onto aquifer materials. As the United States Environmental Protection Agency (EPA) notes: "perchlorate plumes in groundwater can be extensive".[1]

15. A plume is the area of groundwater impacted by a contaminant. Dissolved contaminants are typically present throughout the plume area.

16. VOCs, including PCE and TCE, are organic chemicals that evaporate easily at room temperature and are emitted as gases from solids or liquids. Due to their physical structure, they behave differently than perchlorate in groundwater and soil. When dissolved in groundwater, they migrate slower than the groundwater (are retarded in their migration) since they sorb onto aquifer materials. TCE and PCE can move at a rate up to 10 times slower than the rate of groundwater.[2] PCE has been found to move slower than TCE in groundwater. Due to the same physical properties, perchlorate, TCE and PCE also move at the above rates through soil to the groundwater. As a result, it takes TCE and PCE considerably longer to reach a given off Site location, such as the wells at issue, than perchlorate.

17. Retardation is due to a chemical reacting with the aquifer material and being held up or retarded. As the dissolved chemical moves through the subsurface, in both the unsaturated zone (soil) and the saturated zone, some of the chemical will adsorb or stick to the aquifer material. The result is that the contaminant moves slower than the rate of the groundwater due to the sorption of

the contaminant to the geologic materials. The amount of retardation is dependent on a chemical's physical properties and the characteristics of the aquifer it is migrating through. Some chemicals are more likely to sorb onto aquifer materials than others. Perchlorate in not retarded and migrates at the same rate as groundwater and VOCs are retarded and move slower than the rate of groundwater.

Bermite Site Source Areas

18. Remedial investigations conducted at the Bermite Site identified areas where soil was impacted by perchlorate and VOCs.[3,4] These areas, called source areas, are the primary areas where perchlorate and VOCs migrated downward through the unsaturated zone (the area above the water table) and entered groundwater. The investigations concluded that the source areas were essentially the same for perchlorate and VOCs. This means that the areas where perchlorate and VOCs migrated through the unsaturated zone and entered the groundwater beneath the Bermite Site were essentially the same.

Groundwater Migration Pathways

19. The perchlorate and VOC releases migrated downward through the unsaturated zone to the water table and entered the groundwater. Upon entering the groundwater, these dissolved chemicals begin slowly moving with and in the direction the groundwater was moving. This means that the chemicals that were released and migrated downward to the water table at the Bermite Site followed the same pathway as they migrated downgradient with the groundwater. In other words, perchlorate, TCE and PCE released at the Bermite Site moved with groundwater in the same direction and along the same pathway.

20. The perchlorate data collected from groundwater monitoring wells on and off the Bermite Site and from groundwater production wells show that perchlorate from source areas on the Bermite Site has migrated in groundwater in a northwesterly direction.

21. Figure 2 shows the extent of the perchlorate plume from the Bermite Site source areas (the orange area on Figure 2).[5] The perchlorate plume is over a mile wide and has a total length of approximately 3 ¾ miles.

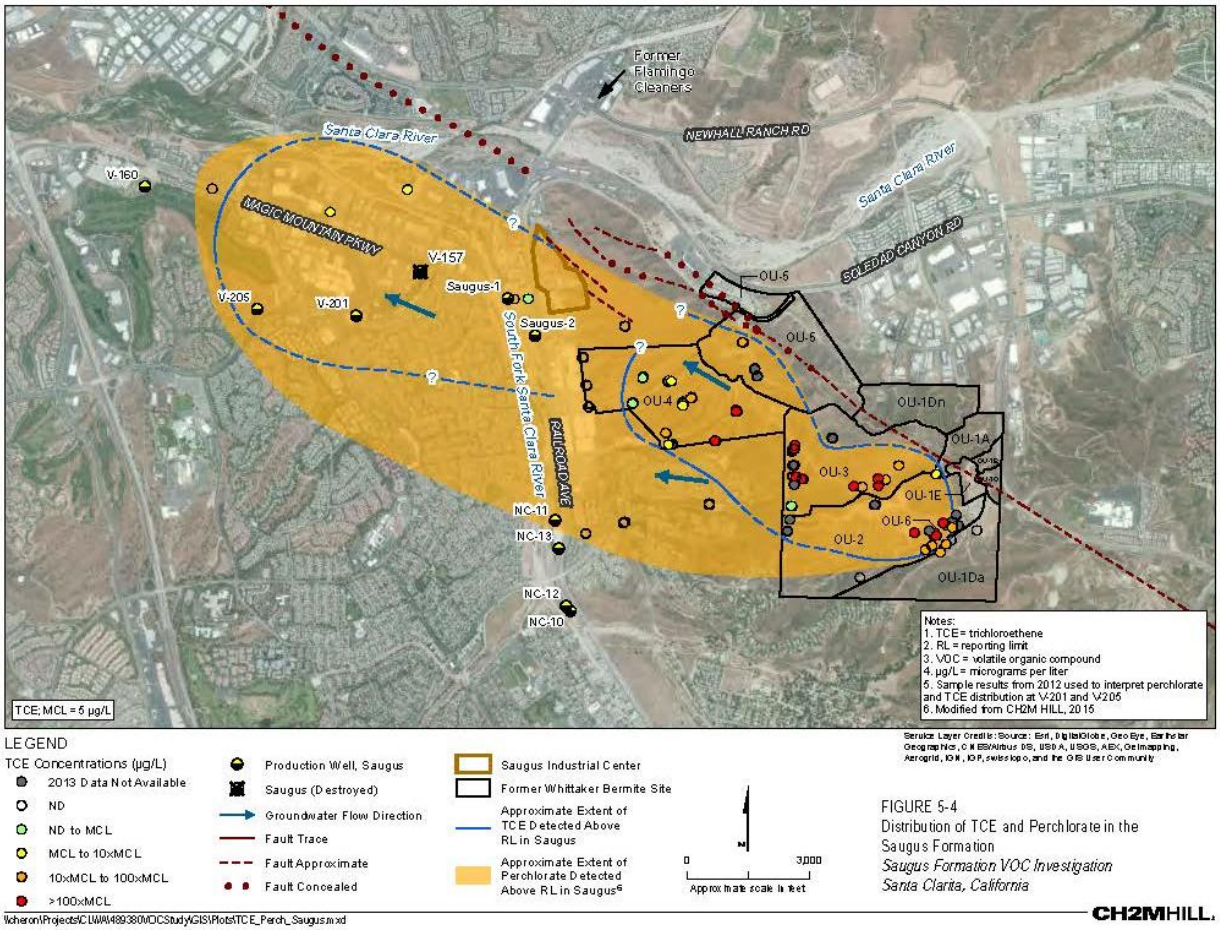

FIGURE 2

22. VOCs from the Bermite Site followed the same pathway as perchlorate. For example, as shown in Figure 3, the TCE plume (purple lines) is

migrating northwest, in the same direction and along the same pathway as the perchlorate plume.[6]

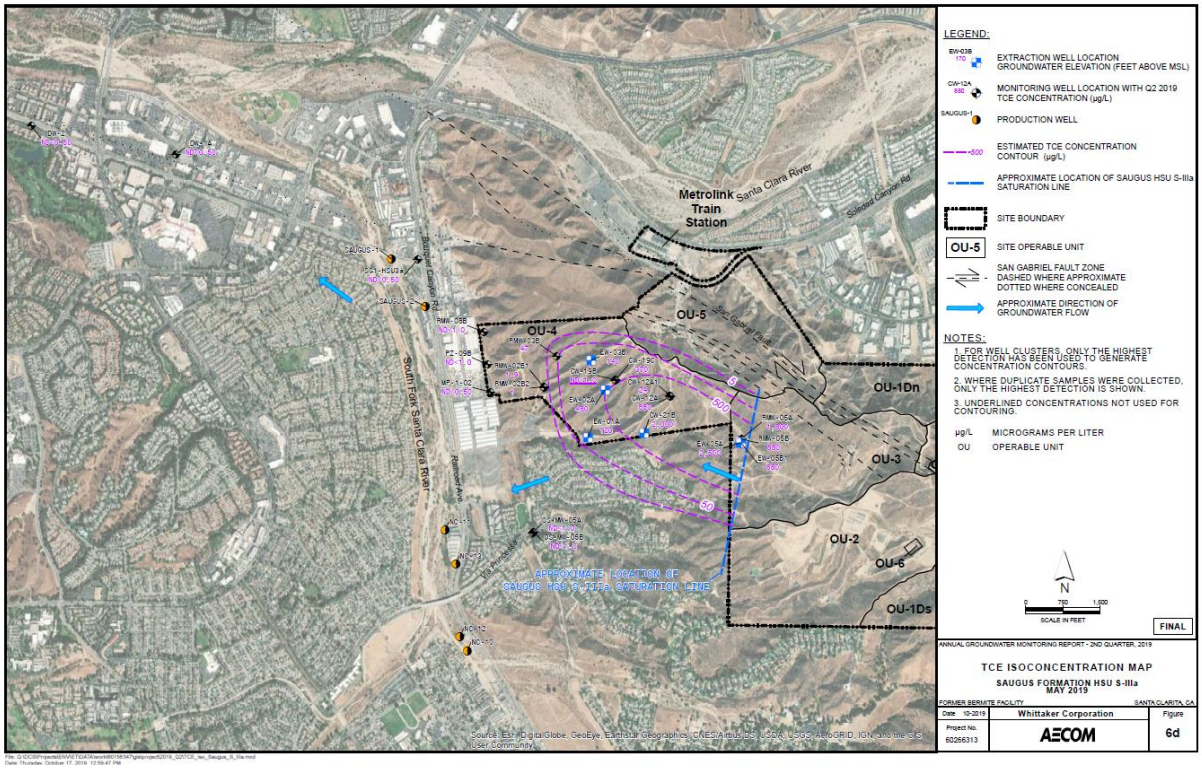

FIGURE 3

23. Figure 3 shows that TCE has not migrated from source areas on the Bermite Site as far as the westernmost boundary of the Bermite Site (labeled OU-4 on Figure 3; the Bermite Site was divided into different Operable Units (OUs) for the investigation). Conversely, Figure 2 shows that perchlorate has moved through the western boundary of OU-4 and migrated further downgradient.

24. A comparison of the perchlorate plume shown in Figure 2 and the TCE plume shown in Figure 3 shows that the perchlorate plume has migrated approximately 2 to 2 ½ times the distance the TCE plume has migrated. This difference in migration distances is due to the retardation of TCE compared to

perchlorate and matches what is expected due to the different physical properties of TCE and perchlorate.

25. TCE and PCE move at a rate slower than the rate of groundwater.[2] They sorb easily. The net result is that due to retardation, perchlorate and VOCs released to groundwater at the same place and time, will travel at different rates. If one chemical moves 2 ½ times slower than another chemical, the faster chemical will travel 2 ½ times as far as the slower moving chemical (ex. 250 feet v. 100 feet).

26. The retardation of TCE at source areas first occurred in the unsaturated zone as the dissolved TCE moved downward to the water table and then as it migrated with the groundwater.

Water Quality Data

27. Water quality data has been collected from a series of groundwater monitoring wells on and downgradient of the Bermite Site since 2003. The water quality data is used to determine the extent of impact of perchlorate and VOCs (where and how far perchlorate and VOCs have migrated from source areas on the Bermite Site).

28. Groundwater monitoring wells have been constructed on the western boundary of OU-4 on the Bermite Site, the closest point to Saugus 1 and Saugus 2 (RMW-08A, -08B, -08C, 08D; PZ-09A, -09B; MP-1A, and MP-1-01 to MP-1-10). (Saugus 1 and Saugus 2 and the groundwater monitoring wells on the western boundary of OU-4 are shown in Figure 4).

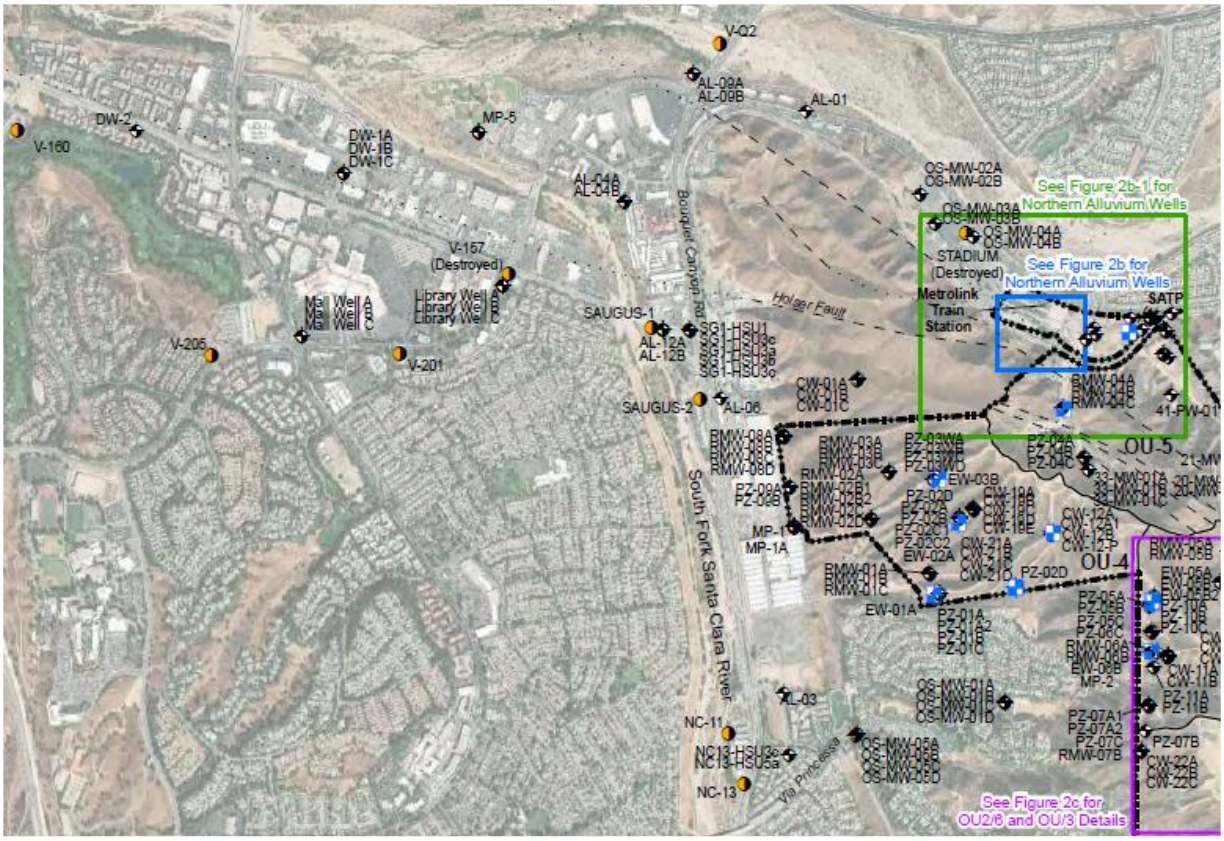

FIGURE 4

29. The groundwater monitoring wells on the western boundary of OU-4 are directly upgradient of Saugus 1 and Saugus 2 and are on the shortest and most direct pathway from source areas on the Bermite Site to the closest production wells, Saugus 1 and Saugus 2. As described above, groundwater production wells V-201 and V-205 are much further downgradient (Figure 4).

30. As verified by water quality data[7], Figure 2 shows that perchlorate has migrated through and beyond this boundary and Figure 3 shows that VOCs have not.

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Perchlorate

31. Four groundwater monitoring wells (a well nest), screened at different depths, are at location RMW-08 on the northwest corner of OU-4 (Figure 4), the closest part of the Bermite Site to Saugus 1 and Saugus 2. These four wells have been sampled 30 times.[7] Perchlorate has been detected in these wells in most of the 30 sampling events. The perchlorate results from these wells show that perchlorate from the Bermite Site has migrated to and beyond this well nest location. In other words, it shows that this location is within the migration pathway for perchlorate and other dissolved chemicals from source areas on the Bermite Site.

32. Two groundwater monitoring wells are at location PZ-09, south of RMW-08 (Figure 4). These wells have been sampled 26 times. Perchlorate was detected in all but one sampling event. The perchlorate results from these wells show that perchlorate from the Bermite Site has migrated to and beyond this well nest location.

33. Location MP-1, south of PZ-09, contains 11 wells screened at different depths. Perchlorate has been detected in all the wells at this location, except two deep wells, MW-1-07 and MW-1-10. The perchlorate results show that perchlorate from the Bermite Site has migrated to and beyond this well nest location toward Saugus 1 or Saugus 2.

34. If VOCs have also migrated to Saugus 1 or Saugus 2, we should also see consistent VOC concentrations in these same wells. However, we do not.

VOCs

35. By contrast, VOCs have not been consistently detected in the wells along the western boundary of OU-4, the shortest pathway from source areas on the Bermite Site to the closest production wells, showing that they have not migrated to this boundary and have not migrated to the Water Agency groundwater production wells.

36. PCE and TCE have been detected in three of the four wells at the RMW-08 location, however, only once. PCE was measured once in RMW-08A once in RMW-08C, and once in RMW-08D. The 29 other samples collected from these wells did not detect PCE. TCE was detected once in RMW-08A and once in RMW-08D. The consistent historical non-detect results indicate that these one-time detections could be due to sampling error, lab error or from another VOC source. However, unlike the consistent detections of perchlorate, the PCE and TCE results show that neither a PCE nor a TCE plume from the Bermite Site has migrated to and beyond the RMW-08 location.

37. PCE was detected only one time in 26 sampling events at PZ-09A. TCE was detected only once in 26 sampling events at PZ-09B. The one-time detections of PCE and TCE indicate that PCE and TCE plumes have not reached this location. Simply, one detection in 26 sampling events shows that a PCE and TCE plume is not migrating through this location, not migrating off site, and not impacting Saugus 1 and Saugus 2.

38. PCE has been detected in two shallow wells at the MP-1 location. The 3rd quarter 2019 water level measurements in this portion of the Saugus Formation show that groundwater flow is in an easterly direction, towards these

wells from off-site.[7] Water quality results are therefore not representative of groundwater from the Bermite Site. TCE was detected once in two of the wells at this location. TCE has been detected in MP-1-01 once in 20 sampling events and once in 31 sampling events in MP-1-04. The one-time detections of TCE indicate a TCE plume has not reached this well nest location.

39. Water quality data shows that a VOC plume is not migrating through the western boundary of the Bermite Site, the shortest and most direct pathway from source areas on the Bermite Site to the Water Agency groundwater production wells.

40. There are also groundwater monitoring wells located north and south of OU-4, between the Bermite Site and the Water Agency groundwater production wells. Three wells are located north of OU-4 between the Bermite Site and Saugus 1 and Saugus 2 (CW-01A, -01B, -01C). Well nest OS-MW-01 (A, B, C and D) is located south of OU-4 and west of OU-2 and OU-3. These wells are shown on Figure 4.

41. All the wells at the CW-01 location have detected perchlorate. PCE and TCE have not been detected in these wells. PCE and TCE plumes have not migrated to and downgradient of the CW-01 location.

42. Perchlorate has consistently been detected in the four monitoring wells at location OS-MW-01, however, PCE and TCE have been detected sporadically. PCE was detected in three out of 66 sampling events in OS-OW-01A and TCE was detected once. The consistent detection of perchlorate in this well shows that this is a flow path for contaminants from source areas on OU-2 and OU-3. The sporadic detections of PCE and TCE shows that PCE and TCE are not

migrating though this location and there is not a plume of these contaminants migrating in this area.

43. PCE was detected in OS-OW-01B two out of 63 sampling events and TCE three times. PCE was detected in OS-OW-01C two out of the 63 sampling events and TCE was detected three times in 63 sampling events. PCE and TCE were detected in OS-OW-01D two out of 56 sampling events. The consistent detection of perchlorate in these wells shows that this is a flow path for contaminants from source areas on OU-2 and OU-3. The sporadic detection of PCE and TCE shows that there is not a plume of PCE and TCE migrating in this area.

V-201 and V-205

44. PCE and TCE have been detected in groundwater production wells V-201 and V-205 below the MCL. Groundwater production wells V-201 and V-205 are west of Saugus 1 and Saugus 2 and further downgradient from the Bermite Site. V-201 is located approximately ¾ mile (3,900 feet) west of Saugus 1. V-205 is located over a mile west of Saugus, approximately 6,200 feet.

45. According to the California State Water Resources Control Board GAMA Groundwater Information System, TCE was first detected in V-201 in 2017 and in 2012 in V-205.[8] Perchlorate was first detected in V-201 in 2010 and first detected in V-205 in 2015. Due to retardation, if both perchlorate and TCE were migrating to V-201 and V-205 from the Bermite Site, TCE should take at least twice as long to arrive at these wells as perchlorate. Instead, TCE was detected in V-205 before perchlorate was detected. And TCE was detected in V-205 before being detected in V-201, although V-205 is located downgradient and

further away from the Bermite Site. Based on the water quality data from V-201 and V-205 the TCE detections in these two groundwater production wells could not be from the Bermite Site.

46. TCE and PCE have been detected in groundwater monitoring wells located in the vicinity of V-201 and V-205.[7] The highest concentrations of TCE have been detected in groundwater monitoring well Mall Well A at 10 µg/L, in Library Well B at 4.8 µg/L, and in Library Well C at 5.1 µg/L (Figure 4, above). TCE has been detected in two well nests north of V-201 and V-205 (DW-1 and MP-5). The highest detections of TCE in these well nests are 16 µg/L in DW-1B, 14 µg/L in MP-5-03 and 15 µg/L in MP-5-04. The concentrations of TCE are higher than concentrations detected in upgradient groundwater monitoring wells. The Bermite site is not the source of these VOC detections and their presence is most likely caused by unidentified sources of VOCs in the vicinity of the Mall wells that is being drawn to V-201 and V-205 by the pumping of V-201.

47. Dr. Mark Trudell, an expert for the Water Agency, testified that he could not conclude that VOC detections in V-201 and V-205 were from the Bermite Site. He testified that the VOC detections were likely from a source other than the Bermite Site.[9]

Surface Water Migration

48. Previous investigations at the Bermite site showed that perchlorate was migrating in surface water in on-site drainages, indicating off-site transport of perchlorate via surface water from rainfall events.[10]

49. The previous investigations also showed that VOCs were not present in surface water samples and were not migrating off-site by a surface water route.

This is likely due to the volatile nature of VOCs, meaning that they evaporate in surface water.

Other Sources of VOCs

50. VOCs, including PCE and TCE, have been widely used by numerous industries and businesses. These chemicals had many uses including as metal cleaners and as dry-cleaning solvents.

51. There are other known sources and potential sources that could be contributing VOCs to the Water Agency's groundwater production wells.[11,12]

Saugus Industrial Center

52. The Saugus Industrial Center (SIC) is located at 26000 Springbrook Avenue in Santa Clarita, California (Figure 1, above). SIC was formerly the Keysor Century manufacturing facility.

53. From 1958 to 2003 the property was used as a PVC processing plant that manufactured pelletized PVC for use in making vinyl discs. Raw materials used and stored at the property included TCE, vinyl chloride monomer (VCM), 1,2 -dichloroethane (1,2-DCA), vinyl chloride, vinyl acetate and toluene in an outdoor processing area in addition to various stabilizers, defoamers and suspension agents. The USEPA reported that more than 50,000,000 pounds per year of VOCs were used as raw materials at the SIC Site. In 1988 alone, 300,000 pounds of TCE were used at the Site.

SIC Geology

54. The SIC Site is underlain by three geologic formations: alluvial sediments, older surficial sediments, and the Saugus Formation.

55. The alluvial sediments are the uppermost formation and were deposited primarily by the South Fork of the Santa Clara River (Figure 4).

56. The alluvial sediments at the SIC Site are primarily comprised of sand, gravel, and boulders and vary in thickness from approximately ten feet on the eastern portion to over 90 feet on the western portion, as reported in 2011 by RAMCO, SIC's consultant.[13]

57. The older surficial sediments are beneath the alluvial sediments and are generally comprised of material that was eroded from upland areas, primarily gravel and sand. These older surficial sediments have been subsequently eroded and are missing over much of the SIC Site.

58. The Saugus Formation underlies both the alluvial and older surficial sediments. Because the older surficial sediments are not present over much of the SIC Site, the Saugus Formation is in direct contact with the alluvial sediments.

59. The Saugus Formation is composed of conglomerate, sandstone, and siltstone. However, the upper surface of the Saugus Formation at the SIC Site is generally unconsolidated and porous, easily transmitting groundwater.

60. In addition to geologic formations at the SIC Site, there is also evidence of faulting. The San Gabriel Fault, the major fault in the area, is present north of the SIC Site. The Holser Fault is associated with the San Gabriel fault and cuts across the SIC Site in a southeast to northwest direction (Figure 5). The Holser Fault is a reverse fault that is steeply inclined to the south/southwest and crosscuts the Saugus Formation.[13,14] There is evidence that the fault is exposed in the canyon walls adjacent to the SIC Site in outcropping Saugus Formation.

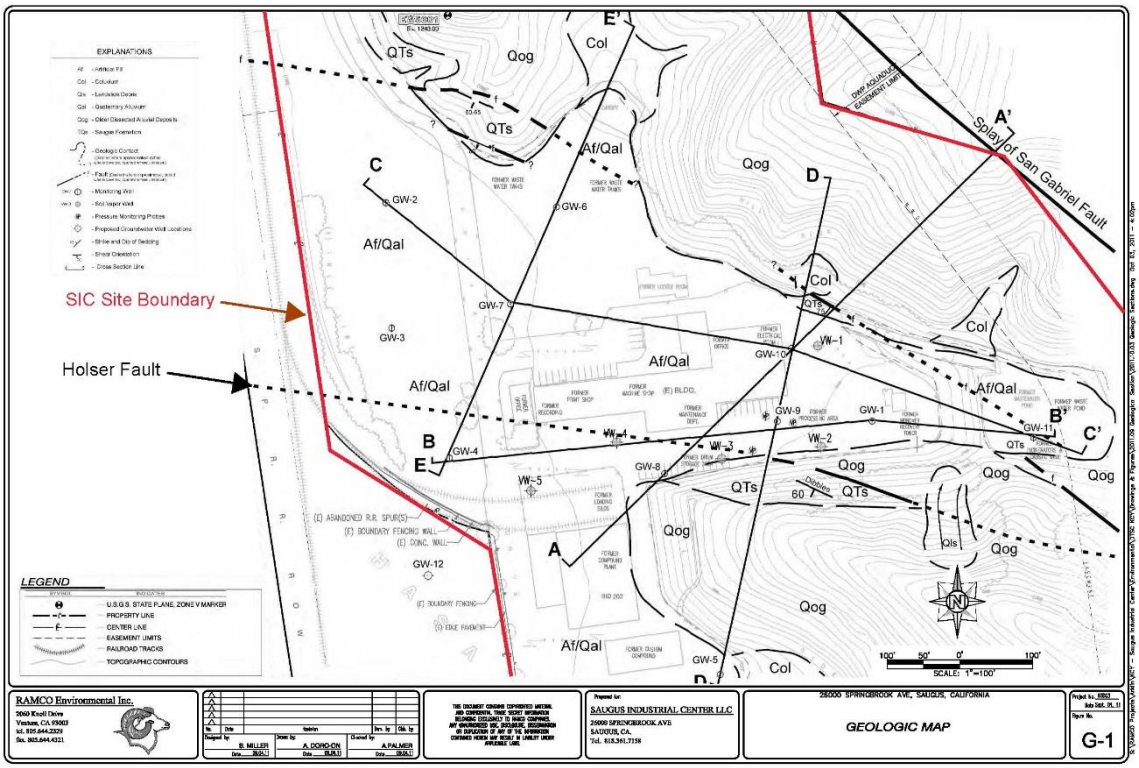

FIGURE 5

61. The faulting at and near the SIC Site has caused the Saugus Formation, which was originally horizontal, to deform and dip to the southwest. The Saugus Formation at the SIC Site has been mapped by RAMCO[13] and Dibblee[14] as dipping 50 to 60 degrees to the south/southwest (Figures 5-9). Figure 6 shows a portion of the Dibblee geologic map in the area where the SIC Site is located and shows the steep dipping angle and direction of the Saugus Formation. Figure 5 shows the location of the cross sections by SIC's consultant RAMCO. Figure 7 is a northeast/southwest cross section that shows the steeply dipping Saugus Formation (labeled QTs on the Figure). Figure 8 is an east/west cross section that also shows the steeply dipping Saugus Formation beneath the SIC Site. The Saugus Formation is approximately 60 feet below ground surface on the western boundary of the Site on Figure 8. Figure 9 is a cross section that trends

slightly southeast to northwest. It shows the alluvial sediments (labeled Qal) approximately 150 feet thick at the Site boundary at the end of the cross section. Further away from the fault zone the Saugus Formation dips between 10 to 15 degrees.[14]

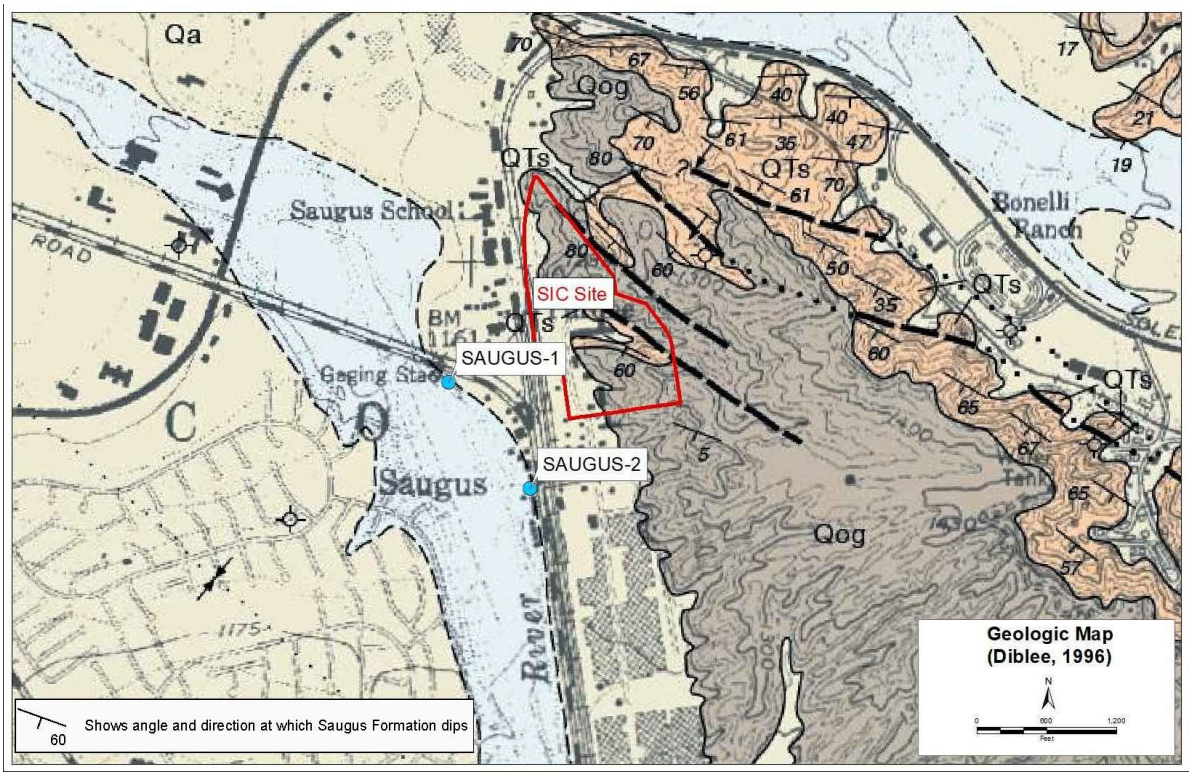

FIGURE 6

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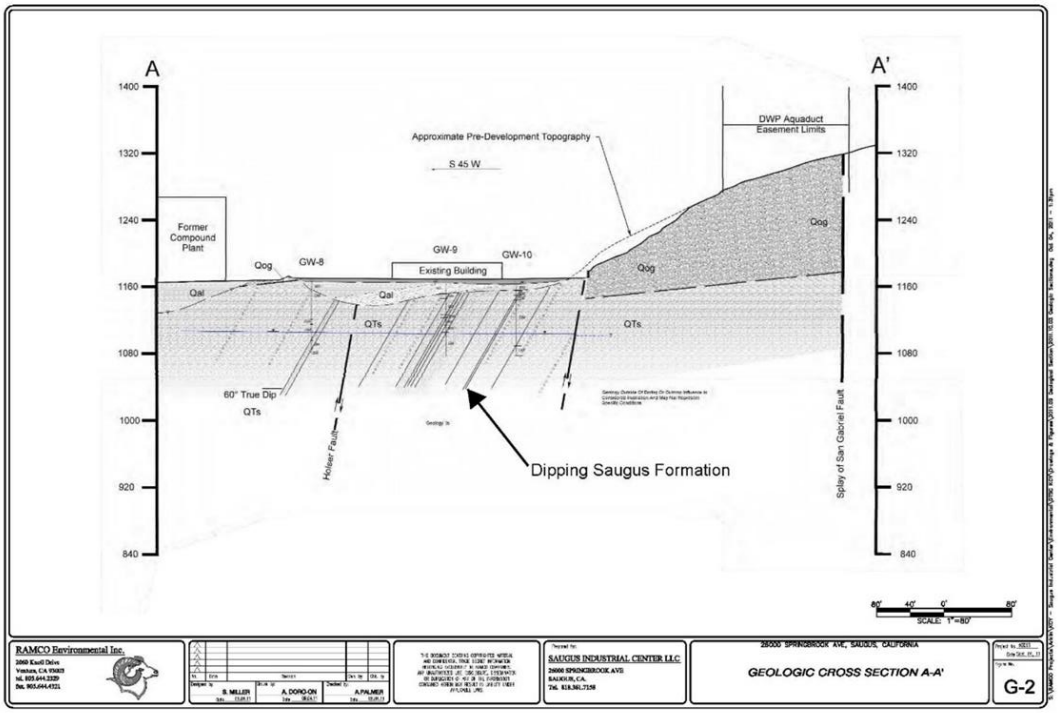

FIGURE 7

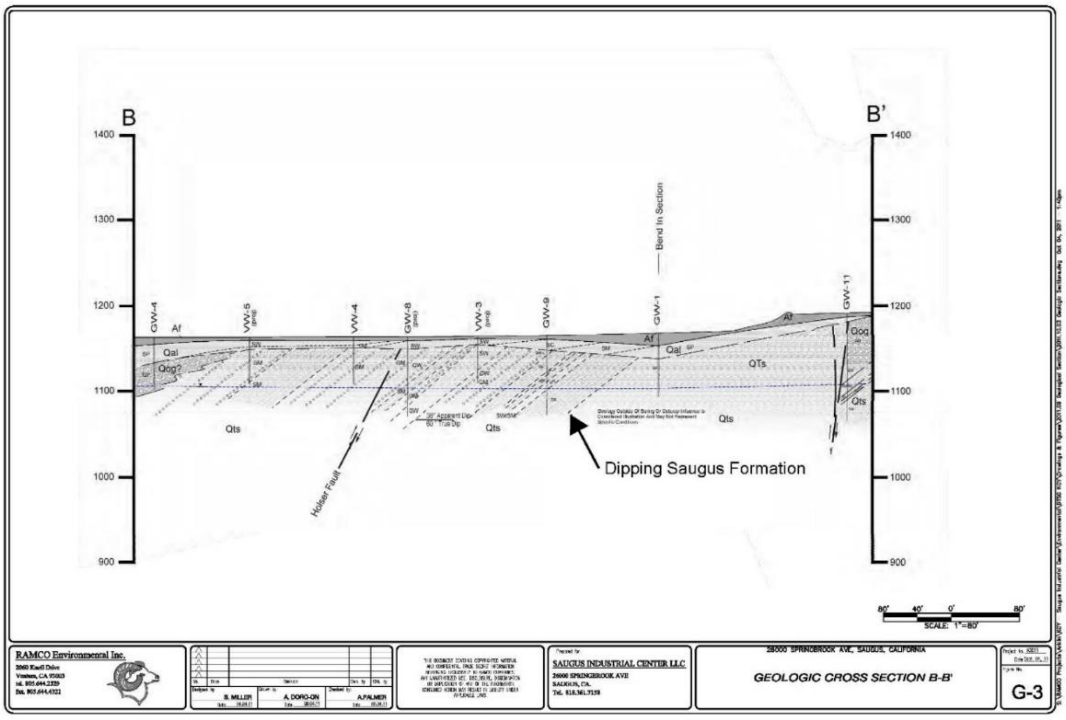

FIGURE 8

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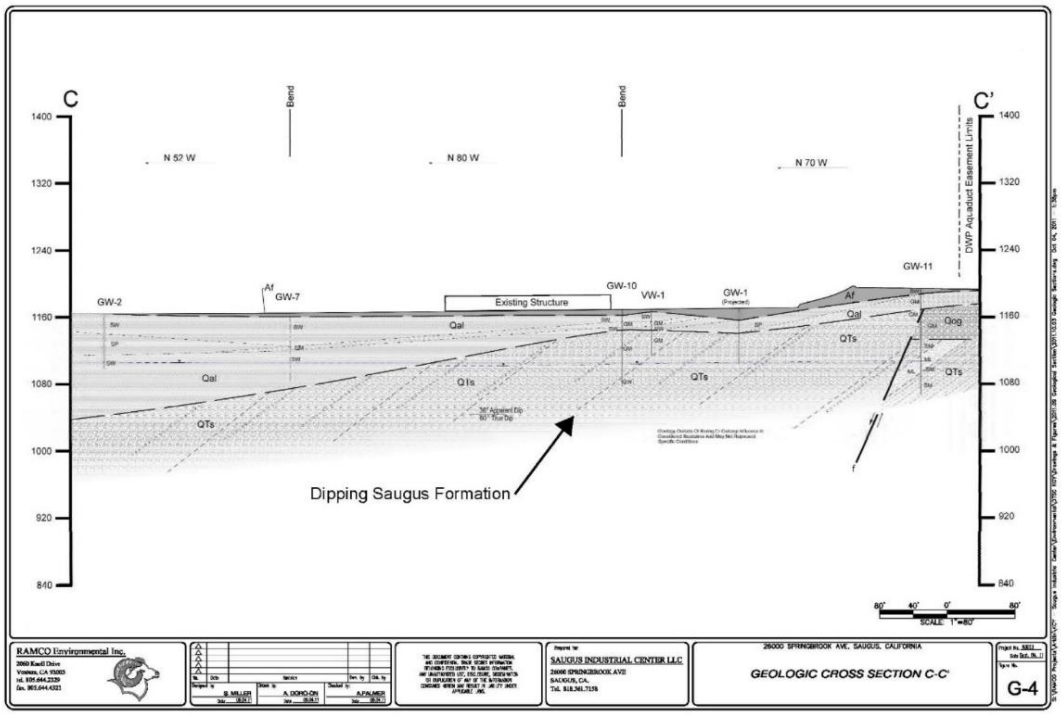

FIGURE 9

SIC Hydrogeology

62. Eighteen groundwater monitoring wells have been installed at the SIC Site to measure water levels and to collect groundwater samples to assist in characterizing the Site (Figure 10).

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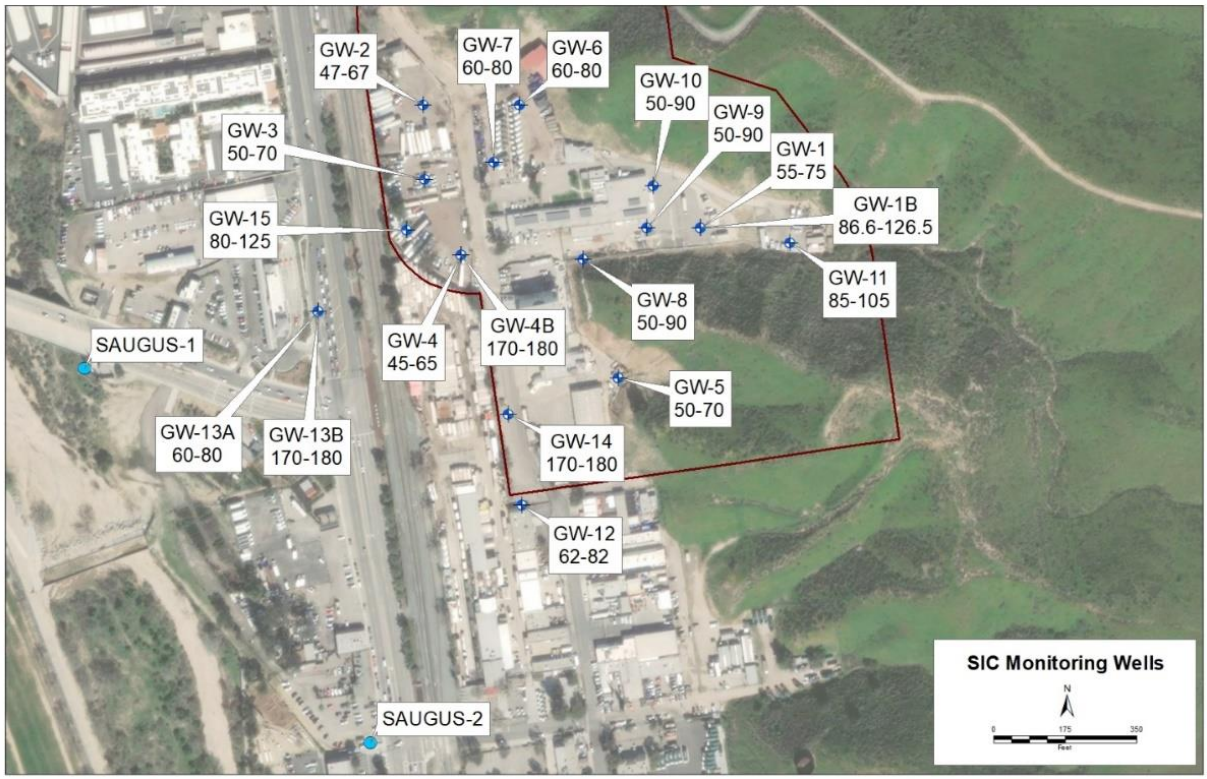

FIGURE 10

63. Thirteen shallow monitoring wells were screened to intersect the water table. These monitoring wells vary between 70 and 105.7 feet deep. All these wells went dry between 2012 and 2015 as the water table in the area lowered.

64. The other five monitoring wells were screened deeper than the shallow wells and did not go dry. These monitoring wells vary between 125 and 180 feet deep.

65. Water levels in these monitoring wells have been measured on a semi-annual basis since 2008.

66. The thickness of the alluvial sediments varies on the SIC Site from approximately 10 to more than 90 feet. The Saugus Formation is directly under the

alluvial sediments on the SIC Site. Over half of the 18 groundwater monitoring wells are screened in the Saugus Formation. All these wells have detected TCE. Currently the water table is present in the Saugus Formation over most of the SIC Site.

67. The alluvial sediments are in direct hydraulic connection with the underlying Saugus Formation.

68. Water table contour maps were generated for the shallow groundwater well network until the shallow wells went dry, due to a lowering of the water table. Water levels could only be measured in the five deeper wells after the shallow wells went dry.

69. Based on the water level measurements in the shallow wells, the groundwater flow direction was variable during the period they were measured from 2008 to 2013.

70. In several of the water table contour maps shallow groundwater flow on the east side of the SIC Site is in a northeast direction and flow on the west side of the Site is west to southwest, towards Saugus 1 and Saugus 2. This variable flow is shown in the water table contour maps in RAMCO's 2011, 2012, and 2013 reports. For example, as shown in the water table contour map for the third quarter of 2012 groundwater flow on the east side of the SIC Site is shown in a northeast direction (Figure 11)[15]. Groundwater flow on the west side of the Site is in a westerly direction towards the Water Agency groundwater production wells. Similarly, in the water table contour map for the second quarter of 2013 groundwater flow on the east side of the SIC Site is shown in a northeasterly direction and groundwater flow on the west side of the SIC Site is shown in a

southwest direction (Figure 12)[16]. The difference in groundwater flow direction may be due to the unique geology at the Site, including the faulting and the severely dipping Saugus Formation. The groundwater divide shown on Figures 11 and 12 (where groundwater flow goes in different directions) is shown as southeast to northwest on the Site. The location of the groundwater divide may be related to the location of the Holser Fault on the Site, which also is in a southeast to northwest direction on the Site (Figure 5).

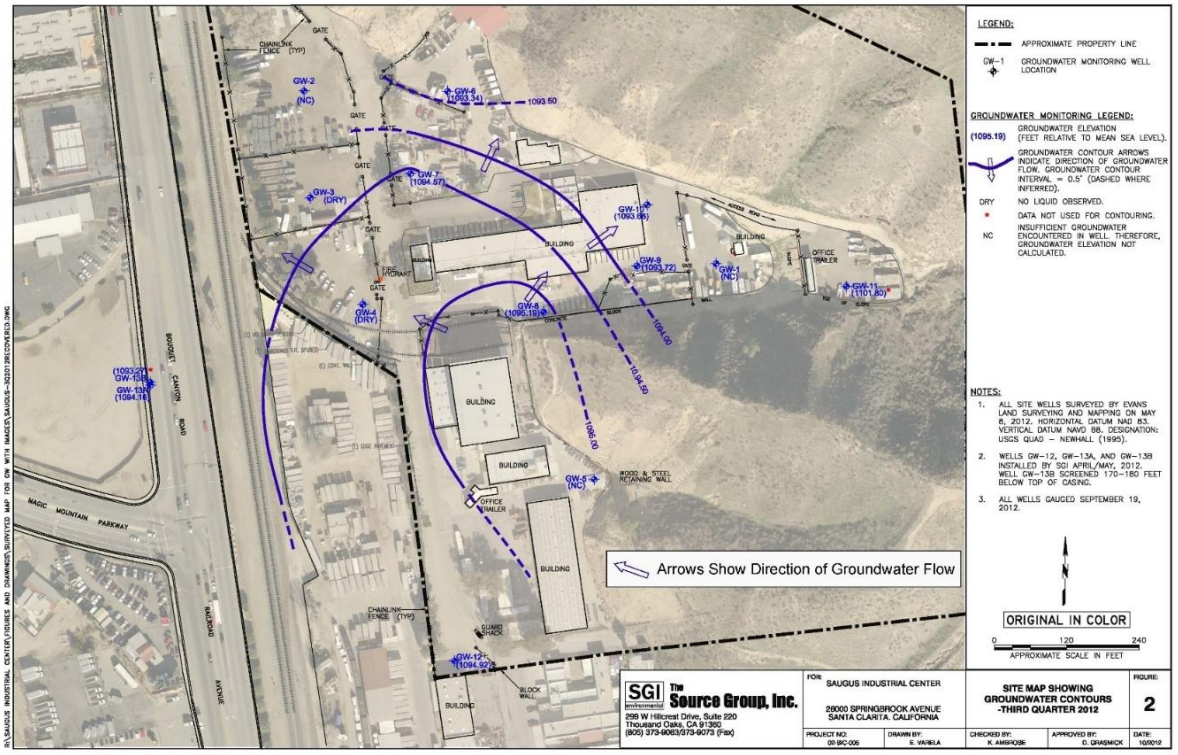

FIGURE 11

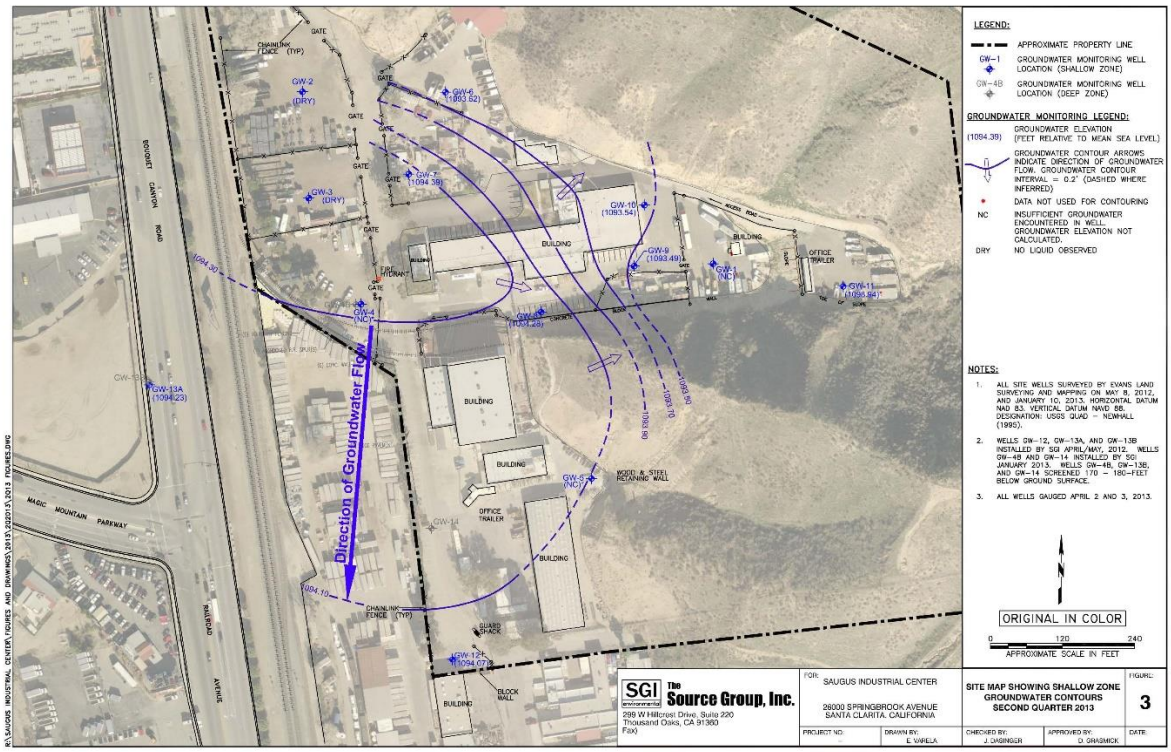

FIGURE 12

SIC Groundwater Quality Data

71. Groundwater samples have been collected from the groundwater monitoring wells at the SIC Site since 2008.[17] The primary constituents detected in groundwater at the SIC Site are TCE, chloroform, PCE, vinyl chloride, cis-1,2-dichloroethene, methyl ethyl ketone, methyl isobutyl ketone, acetone, 1,2-DCA and toluene.

72. TCE has been detected at the SIC Site at a maximum concentration of 4020 µg/L in shallow well GW-4 and 1100 µg/L in deep well GW-15 near the western boundary (Figure 13). TCE has been detected in both off-site monitoring wells, GW-13A and GW-13B, on the west side of Railroad Avenue, approximately

300 feet southwest of the SIC Site. GW-13A is 80 feet deep and GW-13B is 180 feet deep. The maximum concentration of TCE detected in GW-13A was 49 µg/L and 790 µg/L in GW-13B. TCE has also been detected in SG1-HSU3c at a maximum concentration of 2.4 µg/L. Groundwater monitoring well SG1-HSU3c is located approximately 200 feet south of GS-13B and 600 feet east of Saugus 1. SG1-HSU3c is screened at a depth of 720 to 740 feet below ground surface. Groundwater monitoring well AL-12B is located approximately 600 feet southwest of GW-13B. AL-12B is located adjacent to Saugus 1. Monitoring well AL-12B is 180 feet deep. The maximum TCE concentration detected in AL-12B is 240 µg/L. TCE has been detected in AL-12B in all 76 sampling events.

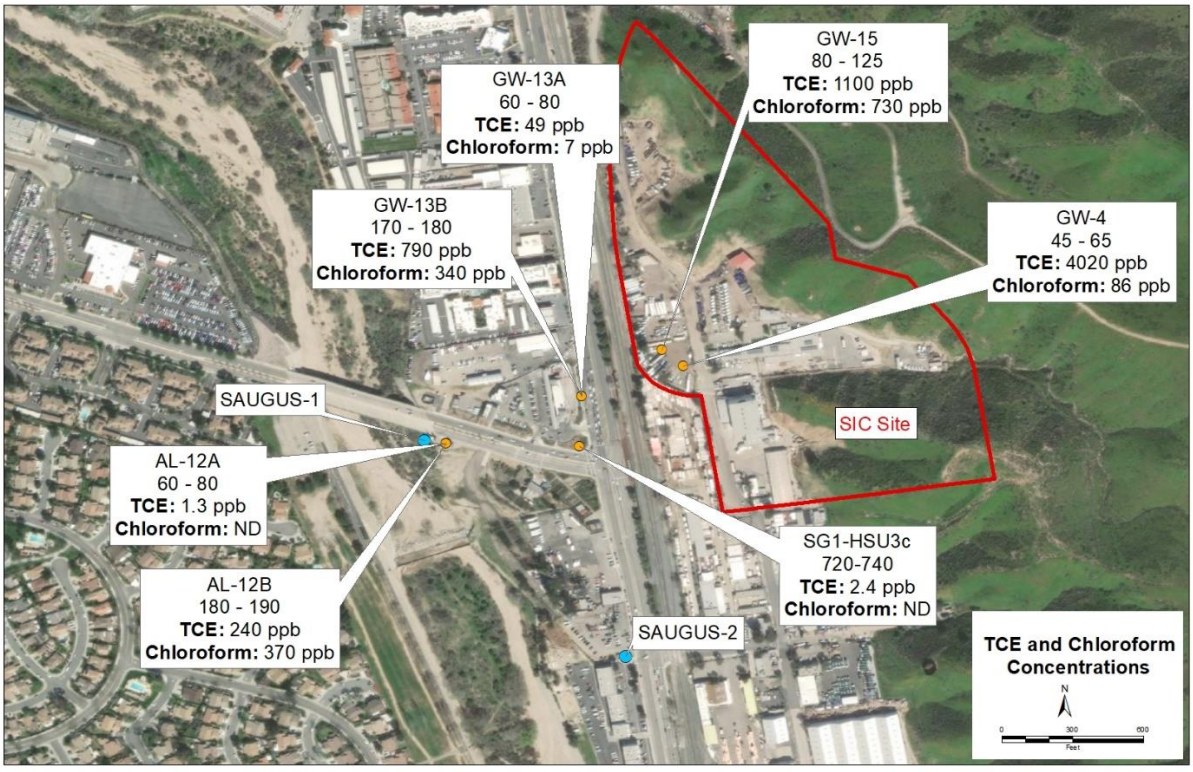

FIGURE 13

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73. Chloroform has also been detected in SIC wells and in AL-12B (Figure 13). The maximum chloroform concentration detected at the SIC Site was 730 µg/L in GW-15. Chloroform was detected at a maximum concentration of 340 µg/L in GW-13B and 370 µg/L in AL-12B.

74. Based on the data collected from SIC monitoring wells and AL-12B, TCE and chloroform have migrated from the SIC Site to the AL-12B location, adjacent to Saugus 1 (Figure 13).

75. Saugus 1 is located 900 feet west/southwest of the SIC Site (Figure 13). Saugus 1 is 1640 feet deep and has eight screen intervals, all in the Saugus Formation. The well screens for Saugus 1 are located from 490-510, 570-630, 710-810, 890-1000, 1020-1080, 1130-1190, 1240-1320, and 1400-1620 feet below ground surface (Figure 14).

76. Saugus 2 is located approximately 1200 feet south of the SIC Site (Figure 13). This well is 1611 feet deep and has seven screen intervals, all in the Saugus Formation. The well screens for Saugus 2 are located from 510-550, 580-720, 820-880, 920-960, 1040-1100, 1210-1250, and 1310-1590 feet below ground surface (Figure 14).

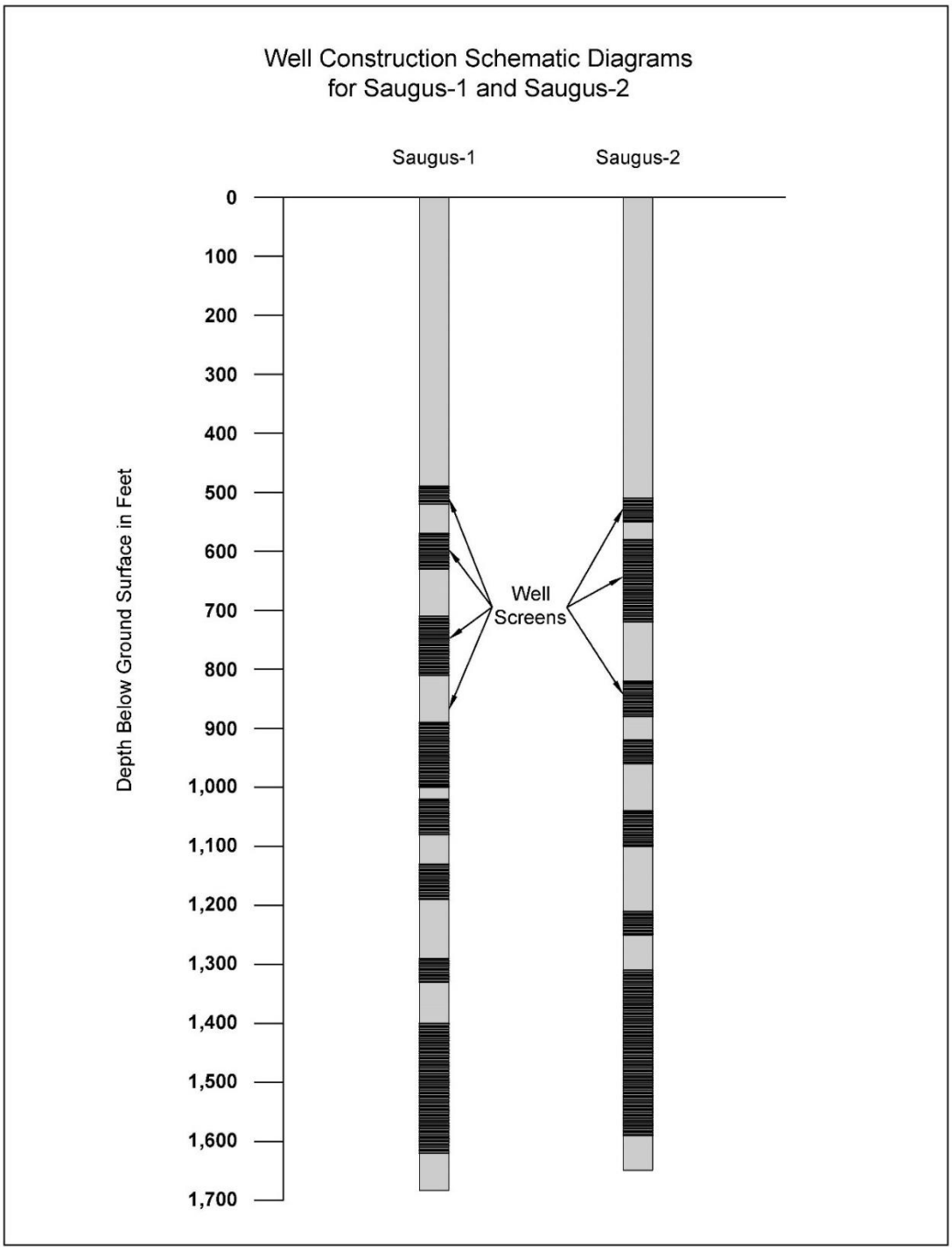

FIGURE 14

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77. When Saugus 1 and Saugus 2 pump groundwater the water enters the well from all the screen intervals at the same time. All the water is pumped from the Saugus Formation.

78. The capture zones for Saugus 1 and Saugus 2 were determined by using a computer model.[18] A capture zone is the area of an aquifer from which groundwater is drawn into a production well when the well is pumping. The capture zone for Saugus 1 extends to and includes the location of groundwater monitoring well SG1-HSU3c and the western portion of the SIC Site itself.

79. As discussed above, the Saugus Formation dips at a 60-degree angle to the southwest at the SIC Site, in the direction of Saugus 1 and Saugus 2. Away from the fault zone where the SIC Site is located, the regional dip of the Saugus Formation is approximately 10 degrees. The transition of the 60-degree dip of the Saugus Formation at the SIC Site to the regional dip of 10 degrees has not been mapped. To estimate where the Saugus Formation that is present under the SIC Site intersects Saugus 1 and Saugus 2 a range of dipping angles between the SIC Site and the production wells is used. The average dipping angle would be 35 degrees (the average of 60 and 10 degrees). The average dipping angle will be bracketed by $\pm$ 5 degrees to produce a range of 30 to 40 degrees.

80. Based on this range, groundwater (and contaminants in the groundwater) migrating in the dipping Saugus Formation would intersect Saugus 1, located 900 feet from the SIC Site, at an approximate depth of 520 to 755 feet below ground surface (bgs).

81. Groundwater (and contaminants) migrating in the dipping Saugus Formation would intersect Saugus 2, located 1200 feet from the SIC Site, at an approximate depth of 690 to 1000 feet bgs.

82. Based on these estimates, groundwater from the SIC Site would enter well screens in both Saugus 1 and Saugus 2. Figure 15 is a conceptual cross section showing the approximate locations of the SIC Site, Saugus 1 and Saugus 2, and the dipping Saugus Formation.

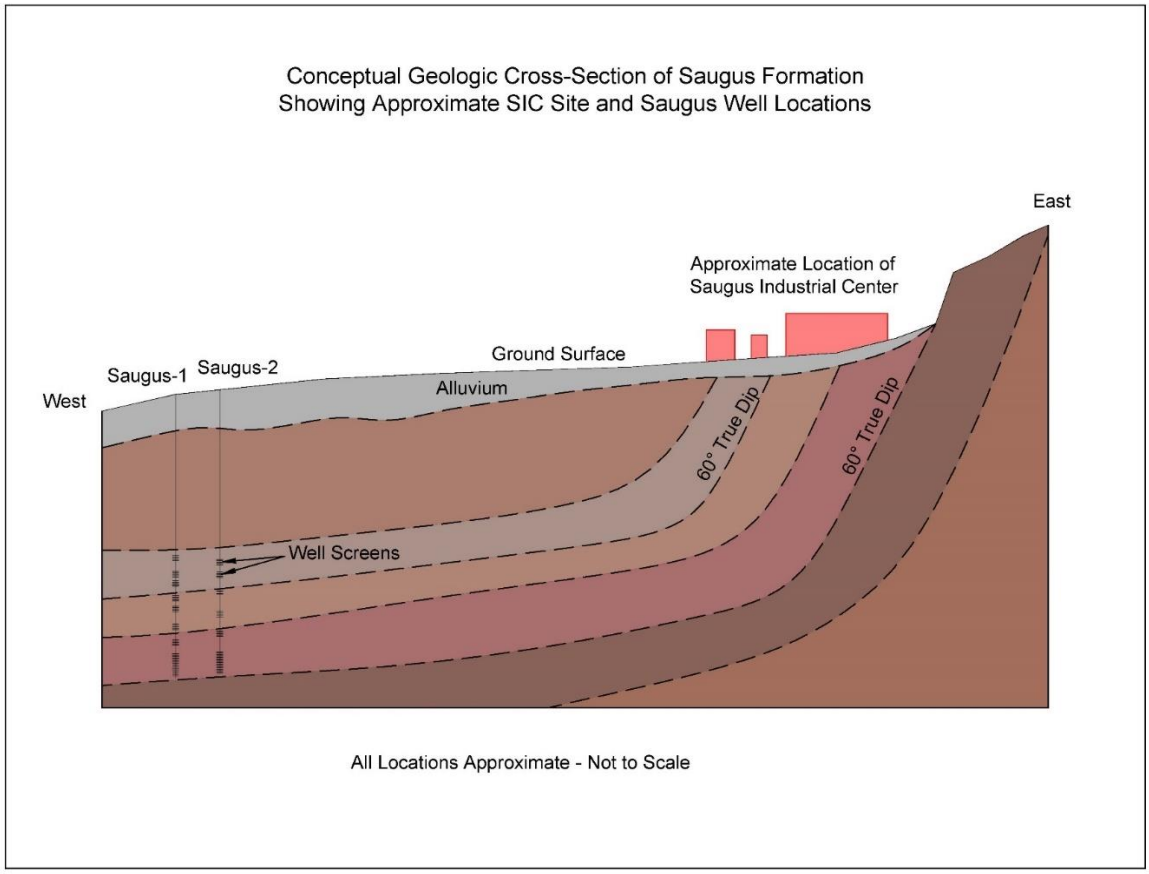

FIGURE 15

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83. TCE has been detected in both Saugus 1 and Saugus 2. The highest concentrations of TCE detected in Saugus 1 and Saugus 2 are 4.2 and 1.2 µg/l, respectively. In 2019 TCE concentrations in Saugus 1 ranged from 0.7 to 1.3 µg/l. TCE concentrations in Saugus 2 groundwater production well in 2019 ranged from <0.5 to 0.6 µg/l. Jose Diaz, the DTSC project manager of this Site, testified that DTSC considers the SIC Site a potential source of VOCs, including TCE, in Saugus 1 and Saugus 2.[19] Benjamin Lechler, a consultant to the Water Agency, testified that there was a plausible pathway for VOCs to move from the SIC Site to the portion of the Saugus Formation where groundwater enters Saugus 1 and Saugus 2.[20]

84. Chloroform has also been detected in Saugus 1 and Saugus 2. Chloroform was detected in 134 of the 141 sampling events in Saugus 1 from 2010 to 2013. In Saugus 2, chloroform was detected in nine of 114 sampling events during the same time.

85. The highest concentrations of TCE and chloroform were detected on the SIC Site. TCE and chloroform have been detected in decreasing concentrations in a westerly direction toward the GW-13 wells, located between the SIC Site and Saugus 1, in SG1-HSU3c, and in AL-12B located adjacent to Saugus 1 (Figure 13).

86. Groundwater contaminated with VOCs, including TCE, is present on the SIC Site. VOCs, including TCE, are also present in Saugus 1 and Saugus 2 located 900 and 1200 feet from the SIC Site. The same is true for chloroform. Groundwater at the SIC Site and the groundwater production wells are each contaminated with TCE and chloroform. Groundwater monitoring data shows that

TCE and chloroform have migrated west across Railroad Avenue and are found in the 180-foot-deep monitoring well AL-12B located adjacent to Saugus 1. The Saugus Formation has been mapped to be dipping 60 degrees to the southwest at the SIC Site in the direction of Saugus 1 and Saugus 2. TCE has been detected in a deeper well screened in the Saugus Formation located between the SIC Site and the groundwater production wells. Contaminated groundwater at the Site is present in groundwater monitoring wells at the SIC Site in the Saugus Formation. TCE has been detected in both Saugus 1 and Saugus 2. Contaminated groundwater migrating in the steeply dipping Saugus Formation would therefore intersect the screened intervals in Saugus 1 and Saugus 2 at depth. Chloroform has consistently been detected in Saugus 1 and occasionally in Saugus 2. A plausible pathway exists for contaminated groundwater from the SIC Site to migrate to Saugus 1 and Saugus 2.

87. Based on the unique geology at the SIC Site, groundwater flow directions, water quality data and the proximity of the SIC Site to Saugus 1 and Saugus 2, there is a plausible pathway for contaminated groundwater to migrate to Saugus 1 and Saugus 2.

Flamingo Cleaners

88. Flamingo Cleaners, located northeast of Saugus 1 and Saugus 2, contaminated soil, soil gas and groundwater with PCE and TCE.[21] Water level measurements in monitoring wells show that groundwater flows to the southwest, in the direction of Saugus 1 and Saugus 2. As discussed below, the Water Agency was not sure if detections of PCE in their water distribution system were from

Flamingo Cleaners, or from another source, but believed that Flamingo Cleaners was the most likely source.

Water Agency's Distribution System

89. The Water Agency utilizes a pipeline network to distribute water to its customers. Turnouts are locations where water is diverted from the main pipeline to smaller pipelines for delivery to Water Agency customers. Water quality is measured at the Saugus 1 and Saugus 2 wells, in the Perchlorate Treatment Plant effluent, and at turnouts.

90. Water samples have been collected and analyzed at the five turnouts (F, SC-1, SC-2, V-5, and V-7) fed by the Perchlorate Treatment Plant for PCE and TCE since 2010.[22,23] TCE and PCE samples have also been collected and analyzed from Saugus 1, Saugus 2, and the Perchlorate Treatment Plant effluent since 2010.

91. Effluent from the Perchlorate Treatment Plant, before it is blended with water from the State Water Project, shows detectable concentrations of TCE and PCE, since the plant is not designed to remove these chemicals from the groundwater from Saugus 1 and Saugus 2. TCE concentrations in the plant effluent have ranged from non-detect to 3.7 µg/L. PCE concentrations in the plant effluent have ranged from non-detect to 1.0 µg/L. The water from the Perchlorate Treatment Plant is blended with water from Castaic Lake. Therefore, absent another source of VOCs, TCE and PCE concentrations measured at the turnouts have to be less than the concentrations in the plant effluent.

92. PCE has been detected at the turnouts at concentrations exceeding the maximum concentrations in the plant effluent. Between 2011 and 2019, PCE was detected at turnouts in concentrations greater than from the plant effluent 25 times.

2930843

For example, in May 2012 the PCE concentrations at turnout SC-1 were 5.7, 7.9, and 9.9 µg/L on three consecutive readings. And PCE was detected at a concentration of 17.0 µg/L at turnout SC-1 on July 16, 2012. If the data is correct, then the only possible explanation is that there is another source of VOCs entering the distribution system.

93. The Castaic Lake Water Agency (CLWA) published a report on March 21, 2013 describing an investigation into these PCE detections at turnout SC-1.[24] The report stated that "CLWA is confident that Saugus 1 and 2 wells are not the source of the recent episodes of high PCE detection." CLWA modified the piping system in the vicinity of turnout SC-1 to eliminate the PCE detections. Although CLWA stated that they had no hard evidence, the PCE detections may have been associated with the former Flamingo Cleaners site which was located about 200 yards southeast of turnout SC-1. In 2014 and 2015, after modifications to the piping system, PCE was detected at turnout SC-1 at concentrations higher than the plant effluent 14 times.

94. Mr. Leserman, Senior Engineer with the Santa Clarita Valley Water Agency, testified that the PCE detections at SC-1 had nothing to do with the Bermite Site.[25,26] The Water Agency was not sure if the detections were from a nearby dry cleaner, Flamingo Cleaners, or from another source, but believed that Flamingo Cleaners was the most likely source. The turnout data suggests that there are sources of PCE in the water supply other than Saugus 1 and Saugus 2. The Water Agency has concluded on several occasions that the Perchlorate Treatment Plant was not the source of the VOC detections at the turnouts and the source could not be determined.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief. Executed on December 14, 2020 in Oakland, California.

Gary Hokkanen

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ENDNOTES

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20. Lechler, B.J., 2019. Deposition transcript. September 25.

21. Randall Consulting Services, 2017. Groundwater Monitoring Report, Former Flamingo Cleaners, 26512 Bouquet Canyon Road, Santa Clarita, CA 91350. March.

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24. Castaic Lake Water Agency, 2013. Draft Report – Investigation into Elevated Tetrachloroethylene (PCE) Levels at CLWA SC-1 Turnout. March 21.

25. Leserman, James, 2019. Deposition transcript. December 4.

26. Leserman, James, 2019. 30 (b) (6) Deposition transcripts, Volume 1 and 2. December 12.

EXHIBIT A

Expert Report of Gary Hokkanen

In the Matter of:

Santa Clarita Valley Water Agency, v. Whittaker Corporation and Does 1-10, Inclusive

United States District Court, Central District of California
Case No. 2:18-CV-6825-GW (RAOx)

Whittaker Corporation v. Keysor-Century Corporation and Saugus Industrial Center

United States District Court, Central District of California
Case No. 2:18-CU-06825-GW-RAO

Prepared by:

Gary Hokkanen, M.S.

Principal Hydrogeologist

EKI B90086.00

3 August 2020

EXHIBIT
314

TABLE OF CONTENTS

EXHIBITS

1. INTRODUCTION

I, Gary E. Hokkanen, have prepared this Expert Report at the request of Bassi Edlin Huie & Blum LLP, counsel for defendant Whittaker Corporation for the matter *Santa Clarita Valley Water Agency v. Whittaker Corporation and Does 1-10, inclusive*, United States District Court, Central District of California (Case No: 2:18-CV-6825-GW (RAOx)) and *Whittaker Corporation v. Keysor-Century Corporation and Saugus Industrial Center,* United States District Court, Central District of California (Case No: 2:18-CU-06825-GW-RAO). The Santa Clarita Valley Water Agency (Water Agency) has alleged that the Whittaker Bermite Site (Bermite Site), located at 22116 West Soledad Canyon Road in Santa Clarita, California, is responsible for detections of chlorinated volatile organic compounds (VOCs), specifically tetrachloroethene (PCE) and trichloroethene (TCE), in their groundwater production wells. I have been retained to evaluate the potential relationship of the Bermite Site and the Saugus Industrial Center to the detection of VOCs in the Water Agency's groundwater production wells.

Summary of Opinions

My opinions are:

1. The investigations at the Bermite Site determined that perchlorate and VOCs were generally released from the same source areas.

2. Perchlorate and VOCs released from the source areas on the Bermite Site followed the same migration pathway in the unsaturated zone and in groundwater.

3. Due to the different migration rates of perchlorate and VOCs in groundwater, releases of perchlorate from the source areas have migrated faster and further than VOCs.

4. Although perchlorate has impacted Water Agency groundwater production wells downgradient of the Bermite Site, based on the differences in migration rates and supported by water quality data, VOCs from the Bermite Site have not migrated to the Water Agency's groundwater production wells and the Bermite Site is not a source of the VOC detections in the wells at issue.

5. VOCs from the Bermite Site have not impacted the Water Agency's groundwater production wells V-201 and V-205.

6. VOCs have contaminated groundwater at the SIC Site and there is a plausible pathway for groundwater from the SIC Site to migrate to the Water Agency groundwater production wells due to the unique geology of the SIC Site and its proximity to the groundwater production wells.

7. SIC has not met the criteria to be a Bona Fide Prospective Purchaser.

8. There are other potential sources that could be contributing VOCs to the Water Agency's groundwater production wells.

9. Based on the available data, other previously unidentified sources could be contributing VOCs in the Water Agency's distribution system.

In formulating the following opinions and preparing this Expert Report, I reviewed and considered the documents listed in Exhibit A. I have relied upon my education, training, and 40 years of experience in the investigation and remediation of contaminated sites. If additional information or documents are provided to me subsequent to the date of this report, I may modify my opinions presented herein, or address other issues as requested by counsel.

2. QUALIFICATIONS AND EXPERIENCE

I am an Engineer and a Hydrogeologist with EKI Environment & Water (EKI), an environmental consulting firm specializing in the investigation and cleanup of contaminated sites. Attached as Exhibit B is a true and correct copy of my current Curriculum Vitae setting forth my professional background, representative projects, and publications in the last 10 years; and a list of other cases in which I testified as an Expert at trial or by deposition during the past 4 years. My education includes a Master of Science degree in Earth Science from the University of Waterloo in Ontario, Canada, with graduate work in the field of contaminant hydrogeology. I also have a Bachelor of Science degree in Civil Engineering from the University of Minnesota, with an emphasis in Environmental Engineering.

I have 40 years of experience in the investigation and remediation of contaminated sites, which includes investigation, development, and implementation of remedial actions; and litigation support. I have been the Project Manager or Principal-in-Charge of the investigation and remediation of contaminated sites throughout the United States and Canada. My investigation and remediation work has involved characterization of groundwater flow systems; analysis of contaminant fate and transport; development of feasibility studies; selection and design of soil, groundwater, and sediment remedial actions; agency negotiations; and technical observation of work performed by potentially responsible parties (PRPs). I have worked on a wide variety of sites, including wood-treatment plants, dry cleaner facilities, landfills, manufacturing facilities, fuel-transfer facilities, oilfields, and disposal sites. Contaminants present at these sites have included chlorinated solvents, hydrocarbons, polycyclic aromatic hydrocarbons, perflorinated chemicals (PFCs – including perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid PFOS), 1,2,3-trichloropropane (TCP), methyl tert-butyl-ether (MTBE), perchlorate, polychlorinated biphenyls (PCBs), nitrate, pentachlorophenol, volatile organic compounds (VOCs), pesticides, and metals.

I currently am a Principal Hydrogeologist and Vice President for EKI, and previously was employed by several consulting firms, including Farallon Consulting, Hokkanen Environmental LLC, Geomatrix Consultants, and Geraghty & Miller. From 1980 to 1982, I was employed by USEPA Region 9, based in San Francisco, California, in the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TSCA) and Superfund (Comprehensive Environmental Response, Compensation, and Liability Act) programs. I have testified at trial or by deposition as an Expert in multiple cases in various federal and state jurisdictions, as set forth in my Curriculum Vitae. My compensation rate for this case is $320 per hour for preparation of this Expert Report, and $480 per hour for deposition and trial testimony.

3. SUMMARY

The Santa Clarita Valley Water Agency supplies water to the Santa Clarita Valley. The Water Agency obtains water from a number of sources, including the State Water Project (SWP), groundwater, and recycled water. Groundwater is obtained from groundwater production wells in two aquifers, the Alluvium and the Saugus Formation. These include 37 Alluvium wells and 10 Saugus Formation Wells (Figure 1 – all numbered Figures are in Exhibit C).

The shallow Alluvium aquifer is associated with the Santa Clara River system, including the main Santa Clara River channel and its tributaries (the Yellow areas on Figure 2). The Alluvium aquifer is primarily comprised of sand and gravel. The Alluvium aquifer, which is the uppermost aquifer, overlies the Saugus Formation, is up to 200 feet thick. The underlying Saugus Formation consists of sandstone, siltstone, and conglomerate. Based on studies in the area, the Saugus Formation has been subdivided into seven main layers (SI to SVII on Figure 3), called hydrostratigraphic units (HSUs). These HSUs are further subdivided by variations in the geologic composition of the individual layers and related differences in hydraulic properties as determined by water level measurements and aquifer testing results. Water levels measured in groundwater monitoring wells have been used to characterize groundwater gradients in each of these HSUs.

In 1997 perchlorate was detected in four of the Water Agency's Saugus Formation groundwater production wells (Saugus 1, Saugus 2, NC-11, and V-157) (Figure 4). Perchlorate was also detected in an Alluvium well (Stadium Well) in 2002. These five groundwater production wells were shut down after the detection of perchlorate. Perchlorate has subsequently been detected in one additional Alluvium well (Q-2) and two Saugus Formation wells (V-201 and V-205). The Saugus 1 and Saugus 2 groundwater production wells were returned to service in 2010 after completion of a Perchlorate Treatment Plant. Groundwater production wells V-157 and the Stadium Well were sealed. V-201 and V-205 have remained out of service and Q-2 was put back into production.

Several VOCs, including PCE and TCE, were detected in the Saugus 1 and Saugus 2 groundwater production wells when they were returned to service in 2010. PCE and TCE, detected in Saugus 1 and Saugus 2, are below the Maximum Contaminant Level (MCL) of 5.0 micrograms per liter (µg/L). PCE and TCE have been detected in groundwater production wells V-201, V-205, and Q-2 below the MCLVOCs have also been detected in groundwater production wells V-201, V-205, and Q-2, are also below the MCL.

The Water Agency retained a consultant to perform a study to determine potential sources of VOCs impacting groundwater production wells Saugus 1 and Saugus 2. The study identified two potential sources, the Bermite Site and the Saugus Industrial Center (SIC) (Figure 4).

The Bermite Site is a former manufacturing facility located at 22116 West Soledad Canyon Road in Santa Clarita, California and consists of approximately 996 acres. It is located east and generally upgradient of Saugus 1, Saugus 2, V-201, and V-205 groundwater production wells (Figure 4). The property was used for explosives and munitions manufacturing from 1934 to 1987. The manufacture of these products involved the use of materials that contained perchlorate, primarily propellants. In addition, chlorinated solvents were reportedly used for degreasing and cleaning activities. Soil, groundwater, and soil gas were impacted by perchlorate and VOCs, including PCE and TCE, as a result of the manufacturing activities at the Bermite Site.

The Saugus Industrial Center (SIC) is located at 26000 Springbrook Avenue in Santa Clarita, California (Figure 4). SIC was formerly the Keysor Century manufacturing facility (Keysor). The property is approximately 32 acres and is located east/northeast and generally upgradient of Saugus 1, Saugus 2, V-201, and V-205. From 1958 to 2003 the property was used as a polyvinyl chloride (PVC) processing plant that produced pelletized PVC for vinyl discs. Raw materials used and stored at the property included vinyl chloride monomer (VCM), TCE, 1,2-dicholoroethane (1,2-DCA), vinyl chloride (VC), vinyl acetate and toluene in addition to various stabilizers, defoamers and suspension agents. The United States Environmental Protection Agency (USEPA) reported that more than 50,000,000 pounds per year of VOCs were used as raw materials at the Site. Soil, groundwater, and soil gas were impacted by VOCs as a result of the manufacturing activities at the Site.

In previous litigation, the Bermite Site was determined to be the primary source of the perchlorate detections in the Water Agency groundwater production wells. Remedial investigations conducted at the Bermite Site identified perchlorate source areas. Perchlorate data collected at and downgradient of the Bermite Site showed that perchlorate migrated from these source areas in a general northwesterly direction into off-site areas.

The Water Agency has alleged that the Bermite Site is also the primary source of VOC detections in the Water Agency groundwater production wells. As will be discussed in detail in this report, the differences in the rate of migration of perchlorate and VOCs in groundwater and the perchlorate and VOC data support a conclusion that VOCs from the Bermite Site have not impacted the Water Agency groundwater production wells. Simply, once dissolved in groundwater, perchlorate and VOCs move or migrate at different rates. The VOCs move up to ten times slower than perchlorate. Although the perchlorate and VOCs have moved with the

groundwater along the same subsurface hydrologic pathway, the perchlorate has traveled much further than the VOCs, due to the different migration rates. Although the perchlorate plume from the Bermite Site has migrated off-site and impacted Water Agency groundwater production wells, the VOCs have moved at a slower rate and have not. The water quality data collected at the Bermite Site supports this conclusion.

To prevent the off-site migration of VOCs a groundwater extraction system was installed at the Bermite Site. The groundwater extraction system began full-scale operation in 2018.

The SIC Site has impacted groundwater with several VOCs. Due to the unique geology of the SIC Site and to its proximity to the Water Agency groundwater production wells there is a plausible pathway for groundwater from the SIC Site to migrate to the Water Agency groundwater production wells.

In December 2003 SIC purchased the property from Keysor through a bankruptcy court sale. SIC asserts that it qualifies as a Bona Fide Prospective Purchaser. Based on a review of the documents from USEPA and SIC's consultants, SIC has not met the criteria to be a Bona Fide Prospective Purchaser.

There are other potential sources that could be contributing VOCs to the Water Agency's groundwater production wells and the Water Agency's water distribution system. These potential sources have not been adequately investigated by the Water Agency.

4. BACKGROUND

4.1 Santa Clarita Valley Water Agency

4.1.1 Overview

The Water Agency supplies water to the Santa Clarita Valley. The Water Agency is comprised of three divisions: Santa Clarita Water Division, Newhall Water Division, and Valencia Water Division. The Water Agency was created in 2018 by consolidating the Castaic Lake Water Agency, the Santa Clarita Water Division, and the Newhall County Water District.

In 2018 the Water Agency provided approximately 78,300 acre-feet (af) of water to their customers. Approximately 65,200 af of the water was for municipal use and approximately 13,100 af was for agricultural and other uses, including private domestic use. The Water Agency obtains water from a number of sources, including the State Water Project (SWP), groundwater, and recycled water. Of the total water used in 2018, approximately 42,000 af was from the SWP and other imported water sources, approximately 35,900 af from

groundwater, and approximately 400 af from recycled water. Groundwater was obtained from two aquifers, the Alluvium and the Saugus Formation. Of the 35,900 af total groundwater from production wells, approximately 26,450 af was from the Alluvium aquifer and approximately 9,450 af was from the Saugus Formation.

4.1.2 Groundwater Production Wells

The Water Agency operates numerous groundwater production wells in the Alluvium aquifer and Saugus Formation. These include thirty-seven (37) Alluvium wells and ten (10) Saugus Formation Wells (Figure 1). Saugus Formation wells include Saugus 1, Saugus 2, NC-12, NC-13, V-159, V-160, V-201, V-205, V-206, and V-207.

The Saugus 1 and Saugus 2 groundwater production wells were installed in 1988. The wells are located along the east side of the South Fork of the Santa Clara River. In 2018, Saugus 1 produced 1609 af of water and Saugus 2 produced 1310 af of water. Saugus 1 is approximately 1100 feet north of Saugus 2. The borehole for Saugus 1 was drilled to 1683 feet below ground surface (bgs). The Saugus 1 well is 1640 feet deep. The borehole for Saugus 2 was drilled to 1649 feet bgs. The Saugus 2 well is 1611 feet deep. Well logs for these two wells are included in Exhibit D. Each of these wells have multiple screens as shown on the well logs and Figure 3. The well screens for Saugus 1 are located from 490-510, 570-630, 710-810, 890-1000, 1020-1080, 1130-1190, 1240-1320, and 1400-1620 feet below ground surface. Saugus 1 is screened in the Saugus Formation HSU SIII (the well screens at 490-510, 570-630, and 710-810 bgs), HSU SV (the wells screens at 890-1000, 1020-1080, and 1130-1190 bgs), and HSU SVII (the well screens at 1240-1320 and 1400-1620 bgs). The well screens for Saugus 2 are located from 510-550, 580-720, 820-880, 920-960, 1040-1100, 1210-1250, and 1310-1590 feet below ground surface. Saugus 2 is screened in the Saugus Formation HSU SIII (the well screens at 510-550 and 580-720 bgs), HSU SV (the well screens at 820-880, 920-960, and 1040-1100 bgs), and HSU SVII (the wells screens at 1210-1250 and 1310-1590 bgs).

The well log for Saugus 1 shows that a sanitary seal was placed from ground surface to 450 feet bgs. Below the sanitary seal, the annular space (the space between the well casing and the drilled borehole) was filled with gravel to the bottom of the borehole to a depth of 1683 feet bgs. The well log for Saugus 2 shows that a sanitary seal was placed to a depth of 460 feet bgs and gravel was placed in the annular space below the sanitary seal to a depth of 1611 feet bgs.

Saugus Formation groundwater production wells V-201 and V-205 are located west of Saugus 1 and Saugus 2. Well V-201 is located approximately 3900 feet west of Saugus 1. Well V-205 is located approximately 6200 feet west of Saugus 1. Alluvium groundwater production well Q-2 is located approximately 4200 feet north/northeast of Saugus 1.

Well V-201 is 1690 feet deep and has ten screened intervals starting at 540 feet bgs with the bottom screen ending at 1670 feet bgs. Well V-201 has a sanitary seal from ground surface to 460 feet bgs and a gravel pack from 460 feet bgs to the bottom of the well. Well V-205 was installed in 1999 and is 1960 feet deep. It is screened from 820-1503 and 1523-1704 feet below ground surface. The annular space is grouted from ground surface to 680 feet and is filled with gravel from 680 feet to 1960 feet.

Several alluvium groundwater production wells are located north of Saugus 1 (Figures 1 and 4). The alluvium groundwater production wells include N, N-7, N-8, S-6, S-7, S-8, and Q-2. Alluvium groundwater production wells N and Q-2 have been in production since at least 1988, when Saugus 1 and Saugus 2 were constructed. Alluvium groundwater production wells S-6, S-7, and S-8 were put into production in 2000, and alluvium groundwater production wells N-7 and N-8 were put into production in 2005. In 2018 these seven alluvium groundwater production wells accounted for 31% of the total groundwater production from all 37 Water Agency groundwater production wells. Since these wells are screened in the Alluvium aquifer, the groundwater produced by these wells is from that aquifer.

Saugus 1 and Saugus 2, constructed in 1988, began operation in 1991 and 1990, respectively. Since Saugus 1 and Saugus 2 were restarted in 2010 they have pumped an average of 1480 and 1408 af per year, respectively, for an average yearly total of 2888 af. The seven alluvium groundwater production wells north of Saugus 1 and Saugus 2 combined pumped an annual average of 6454 af from the alluvium aquifer from 2011 to 2019 or more than two times the amount of groundwater pumped by Saugus 1 and Saugus 2.

4.1.2.1 Impact to Groundwater Production Wells

As described in the Introduction, several Water Agency groundwater production wells have been impacted by perchlorate and VOCs. The following sections provide information on these impacts.

Perchlorate

In 1997 perchlorate was detected in four of the Water Agency's Saugus Formation production wells: Saugus 1, Saugus 2, NC-11, and V-157. In 2002, perchlorate was also detected in an Alluvium well: Stadium Well. Following detection of perchlorate, all five wells were shut down. In 2005, perchlorate was also detected in Alluvium well Q-2. Well V-157 and the Stadium Well were subsequently sealed. Saugus 1 and Saugus 2 were returned to service in 2010 after construction of the Perchlorate Treatment Plant. The Perchlorate Treatment Plant removes the perchlorate from the water from Saugus 1 and Saugus 2. Well NC-11 has remained out of service.

In 2010 perchlorate was detected in another Saugus Formation well, V-201. The well was taken out of service and has remained out of service. Perchlorate was detected in Saugus Formation well V-205 in 2012. V-205 was also taken out of service and remains out of service.

VOCs

VOCs have been detected in several Water Agency groundwater production wells. The VOCs most commonly detected have been PCE and TCE. PCE and TCE were detected in Saugus 1 and Saugus 2 when they were restarted in 2010. TCE has been detected in V-201 and V-205, however PCE has not been detected in these two Saugus Formation groundwater production wells. The highest concentrations of PCE detected in Saugus 1 and Saugus 2 are 1.2 and 0.8 µg/L, respectively. PCE has been consistently detected in Saugus 1, but infrequently in Saugus 2. Of the approximately 450 samples collected from Saugus 2 between 2010 and 2019, PCE has been detected 26 times (or approximately 6%). TCE has consistently been detected in both Saugus 1 and Saugus 2. The highest concentrations of TCE detected in Saugus 1 and Saugus 2 are 4.2 and 1.2 µg/L, respectively. In 2019 TCE concentrations in Saugus 1 ranged from 0.7 to 1.3 µg/L. TCE concentrations in Saugus 2 in 2019 ranged from <0.5 to 0.6 µg/L. The Maximum Contaminant Level (MCL) for both PCE and TCE is 5 µg/L. PCE and TCE have not been detected above the MCL in either Saugus 1 or Saugus 2. MCLs were established by USEPA to protect the public against consumption of drinking water contaminants that present a risk to human health. An MCL is the maximum allowable amount of a substance that is allowed in public water systems under the Safe Drinking Water Act.

TCE concentrations detected in V-201 have ranged from 0.51 to 0.87 µg/L. PCE has not been detected in V-201. TCE concentrations in V-205 have ranged from 0.51 to 0.92 µg/L. PCE has not been detected in V-205. TCE and PCE have been detected in alluvium groundwater production well Q-2. TCE was detected once, in 1993, at a concentration of 0.6 µg/L. PCE concentrations detected in Q-2 ranged from 0.5 to 2.6 µg/L. The last detection of PCE in Q-2 was in 1993.

Both Saugus 1 and Saugus 2 are screened in the HSU SIII, SV, and the SVII Formations (Figure 3). Saugus 1 has eight well screens and Saugus 2 has seven well screens. When these wells are pumping, water enters the wells through each of the screens. It has not been determined which of the well screens TCE and PCE are entering Saugus 1 and Saugus 2. It has also not been determined which well screens TCE and PCE are entering the well and at what concentrations. It would be expected that the TCE and PCE concentrations detected at the surface sampling location would generally be based on the amount of water entering each well screen and the concentration of TCE and PCE in that water.

A number of additional VOCs have been detected in Saugus 1 and Saugus 2. The most frequently detected additional VOCs have been chloroform and 1,1-dichloroethene (1,1-DCE). Chloroform was detected in 134 of the 141 sampling events and 1,1-DCE was detected in 115 of the 141 sampling events in Saugus 1 from 2010 to 2013. In Saugus 2, chloroform was detected in 9 of 114 sampling events and 1,1-DCE was detected in 11 of 141 sampling events during the same time period. However, all of the additional VOCs, except chloromethane, have been detected below the reporting limit (RL), or below the lowest concentration of the substance tested that can be reported reliably under normal laboratory conditions.

Water Distribution System

The Water Agency utilizes a pipeline network to distribute water to its customers as shown in Figure 5. Turnouts are the locations where the blended water is diverted from the main pipeline to smaller pipelines for delivery to Water Agency customers. Water quality is measured at the Saugus 1 and Saugus 2 wells, in the Perchlorate Treatment Plant effluent, and at turnouts.

Water samples have been collected and analyzed at the five turnouts (F, SC-1, SC-2, V-5, and V-7), fed by the Perchlorate Treatment Plant, for TCE and PCE since 2010. TCE and PCE samples have also been collected and analyzed from Saugus 1, Saugus 2, and the Perchlorate Treatment Plant effluent since 2010.

Effluent from the Perchlorate Treatment Plant usually shows detectable concentrations of TCE and PCE, since the plant is not designed to remove these chemicals from the groundwater from Saugus 1 and Saugus 2. TCE concentrations in the plant effluent have ranged from non-detect to 3.7 µg/L. PCE concentrations in the plant effluent have ranged from non-detect to 1.0 µg/L. The water from the Perchlorate Treatment Plant is blended with water from Castaic Lake. Therefore, TCE and PCE concentrations measured at the turnouts should be less than the concentrations in the plant effluent. The Water Agency uses chloride concentrations measured in the effluent from the Perchlorate Treatment Plant and the Castaic Lake water and the chloride concentrations in the water at the turnouts to estimate the dilution of the water from the Perchlorate Treatment Plant. An examination of the estimated dilution ratios at the turnouts shows large variations in single sampling events. For example, on February 11, 2019, the dilution ration at turnout SC-1 was 88% and -184% at turnout SC-2. On November 12, 2019, the dilution ratio at turnout SC-1 was 73.7% and 5.3% at turnout SC-2. And on December 2, 2019 the dilution ratio at turnout SC-2 was -11.2% and 55.6% at turnout V-5. This variability of dilution ratios suggests that the predicted ratios are not reliable. I have seen no evidence that the chloride ratio method of predicting the dilution at the turnouts has been validated by the Water Agency.

The estimated dilution ratio is used to predict the TCE and PCE concentrations at the turnouts. These predicted TCE and PCE concentrations are compared to the measured values at the turnouts. An examination of the predicted TCE and PCE to the measured values shows variable results. The chloride derived ratios sometimes predict detection and no VOC is detected and other times the predicted VOC concentration is close to the measured value and other times its significantly different. Further, there are times in which the predicted dilution would produce VOC concentrations at the Perchlorate Treatment Plant that are impossible.

In addition, PCE has been detected at the turnouts at concentrations exceeding the maximum concentrations in the plant effluent. There are times in which the predicted dilution ratios do not correlate with the VOC concentrations at the turnouts. Between 2011 and 2019, PCE was detected at turnouts over the concentration from the plant effluent 25 times. For example, in May 2012 the PCE concentrations at turnout SC-1 were 5.7, 7.9, and 9.9 µg/L on three consecutive readings. And PCE was detected at a concentration of 17.0 µg/L at turnout SC-1 on July 16, 2012. The Castaic Lake Water Agency (CLWA) published a report on March 21, 2013 describing an investigation into these PCE detections at turnout SC-1. The report stated that "CLWA is confident that Saugus 1 and 2 wells are not the source of the recent episodes of high PCE detection." CLWA modified the piping system in the vicinity of turnout SC-1 in an attempt to eliminate the PCE detections. Although CLWA stated that they had no hard evidence, the PCE detections may have been associated with the former Flamingo Cleaners site which was located about 200 yards southeast of turnout SC-1. In 2014 and 2015, after modifications to the piping system, PCE was detected at turnout SC-1 at concentrations higher than the plant effluent 14 times.

Mr. Leserman, Senior Engineer with the Santa Clarita Valley Water Agency, testified that the PCE detections at SC-1 had nothing to do with the Whittaker Site. The Water Agency wasn't sure if the detections were from a nearby dry cleaner, Flamingo Cleaners, or from another source. The turnout data suggests that there are sources of PCE in the water supply other than Saugus 1 and Saugus 2. The Water Agency has concluded on several occasions that the Perchlorate Treatment Plant was not the source of the VOC detections at the turnouts and the source could not be determined.

4.1.3 CH2MHill VOC Report

The Water Agency retained CH2MHill to conduct an evaluation of potential sources of VOCs impacting groundwater production wells Saugus 1 and Saugus 2. CH2MHill evaluated known clean-up sites within a search area defined by groundwater modeling of the capture zones of Saugus 1 and Saugus 2 and concluded that there were only two potential sources, the Bermite Facility and the Saugus Industrial Center. CH2MHill limited their evaluation to sites identified

on the California Water Resources Control Board or the Department of Toxic Substances Control (DTSC) websites. They did not evaluate potential sites that were not identified on these websites and eliminated as potential sources sites that had inadequate information to determine if they could have released TCE or PCE. CH2MHill published their findings in a report entitled *Saugus Formation Volatile Organic Compound Investigation Report, Santa Clarita, California* dated October 2015 (CH2MHill VOC Report).

CH2MHill also developed "conceptual migration pathways" from the two potential sources. Mr. Lechler, the primary author of the VOC Report, testified that these conceptual migration pathways were "hypothetical". The CH2MHill VOC Report recommended that additional information should be collected to characterize these hypothetical pathways. Mr. Lechler testified that the additional information was needed because it couldn't be concluded that the Bermite Site was the source of VOCs in Saugus 1 and Saugus 2. Mr. Lechler testified that the recommended data has not been collected.

4.2 Whittaker

The Bermite Site was previously identified as the primary source of the perchlorate detections in the Water Agency groundwater production wells. The Water Agency has alleged that the Bermite Site is also the primary source of VOCs to their groundwater production wells. The following sections describe the history of the Bermite Site, the environmental investigations that have been performed at the Site, identified perchlorate and VOC source areas, and groundwater quality at and downgradient of the Site.

4.2.1 History of Operations

The Bermite site is a former manufacturing facility located at 22116 West Soledad Canyon Road in Santa Clarita, California and consists of approximately 996 acres (Figure 6). The property was used for explosives and munitions manufacturing from 1934 to 1987. Manufactured products included flares, fireworks, pyrotechnic devices, explosives, detonators, fuses, munitions, and missile rocket motors. The manufacture of these products involved the use of material that contained perchlorate, primarily propellants. In addition, chlorinated solvents, including PCE and TCE, were reportedly used for degreasing and cleaning activities. TCE was phased out in the 1960's and replaced by 1,1,1-trichloroethane (TCA). Soil, groundwater, and surface water runoff were impacted as a result of the manufacturing activities at the Site.

4.2.2 History of Operations

Remedial investigations have been conducted at the Site since the mid-1980s. The investigations have included the collection of soil, soil gas, and groundwater samples. Other investigative techniques have also been used to characterize the geology and hydrogeology of the Bermite Site including measurement of water levels, geophysical surveys, and pumping tests. The first investigations of the Site were conducted by Wenck Associates Inc. (Wenck) in 1986-1987. During the initial investigations, Wenck collected and analyzed soil and soil gas samples. The first groundwater monitoring wells were installed in 1988. VOCs were detected in one of the wells in the April 1989 sampling event and the results were reported to the California Department of Health Services in May 1989. The facility was instructed to report these findings to the Regional Water Quality Control Board, USEPA Region 9, and the local water supply companies. Letters were sent to two local water companies.

A series of remedial investigations followed the initial work performed by Wenck. During this process the Site was divided up into several areas called Operable Units (OU-1 to OU-6), based on the location of known source areas, local watersheds, former manufacturing operations, and the affected media (Figure 6). Groundwater impacted by the Site is designated Operable Unit 7 (OU-7). Groundwater monitoring wells have been installed at the Site during the remedial investigations. During the last reported sampling event in the 3rd Quarter of 2019, water levels were measured in 211 monitoring wells. During this sampling event groundwater samples were collected from 75 monitoring wells. Several off-site monitoring wells are included in the quarterly sampling events. A well location map is shown in Figure 7 and detailed well location maps are shown in Figures 8, 9, and 10.

The following sections provide a summary of the results of the remedial investigations conducted at the Bermite Site.

4.2.2.1 Geology/Hydrogeology

Geology

The area in the vicinity of the Bermite Site is characterized by two primary aquifers, the Alluvium and the Saugus Formation. The Alluvium is the uppermost water bearing unit and consists of sand, gravel and boulders. It is associated with the Santa Clara River system, including the main Santa Clara River channel and its tributaries (Figure 2). The aquifer overlies the Saugus Formation and varies in thickness and is up to 200 feet thick. Outside the physical limits of the Santa Clara River system, portions of the Saugus Formation are overlain by Terrace Deposits. The Terrace Deposits are brown to reddish brown sands, silts, and gravel and are up to 200 feet thick in the area. Terrace deposits overlie the Saugus Formation in the southern

and western portions of the Bermite Site and reach a thickness of 200 feet (Qt on Figure 2). Perched water at the base of the Terrace Deposits has been observed at certain locations in the area.

The underlying Saugus Formation consists of sandstone, siltstone, and conglomerate. At the Bermite Site, the upper portion of the Saugus Formation is often highly weathered and has the characteristics of unconsolidated soil. Based on studies in the area, the Saugus Formation has been subdivided into seven main layers (S-I to S-VII), called hydrostratigraphic units (HSUs). These HSUs are subdivided by variations in the composition of the layer and differences in hydraulic properties as determined by water level measurements and aquifer testing results. The layers of the Saugus Formation dip to the northwest (Figure 3). Water levels measured in groundwater monitoring wells have been used to characterize groundwater flow in each of these HSUs.

The area is also characterized by the San Gabriel Fault Zone. Figure 6 shows the location of the main San Gabriel Fault and another mapped fault, the Holser Fault. The San Gabriel Fault has been shown to be a barrier to groundwater flow in the Saugus Formation. Water levels on either side of the fault show significant differences, as large as 100 feet. These water level differences indicate that the fault is a barrier to groundwater flow.

The seven Saugus Formation HSUs have been further subdivided. SIII has been subdivided into S-IIIa, S-IIIb, and S-IIIc. Also, SV has been subdivided into S-Va, S-Vb, and S-Vc. HSUs S-I, S-IIIa, S-IIIc, S-Va, S-Vc, and S-VII, are considered water bearing aquifers. HSUs S-II, S-IIIb, S-IV, S-Vb, and S-VI are considered aquitards, meaning these units have lower permeability and impede vertical groundwater flow.

Within the San Gabriel Fault Zone HSU S-III is unconsolidated, meaning it is not subdivided into the S-IIIa, S-IIIb, and S-IIIc subunits.

Hydrogeology

Water levels have been measured in groundwater monitoring wells screened in the Alluvium and the Saugus Formation. Potentiometric surface maps from the most recent reported sampling event for the Alluvium, S-I, S-IIIa, S-IIIc, and S-Va HSUs are shown in Figures 11 to 17. The potentiometric surface maps show groundwater elevations above mean sea level determined from water levels measured in each well. The groundwater elevations are contoured on the maps showing the groundwater gradient. Groundwater flow is in a downgradient direction and is shown by arrows on the maps.

Figure 11 shows the groundwater flow direction in the Alluvium aquifer to the northwest along the main Santa Clara River channel. Figure 12 shows the groundwater flow direction in the Unconsolidated Saugus to the northwest. Figure 13 shows the groundwater gradient direction in HSU S-I to the east, towards the Bermite Site, and further downgradient the flow direction is northwest. The dashed blue line on Figure 13 shows the approximate extent of saturated conditions in HSU S-I. This means that saturated groundwater conditions in HSU S-I do not exist east of the dashed blue line. Figure 14 shows water levels measured in HSU S-III. Figure 15 shows the groundwater flow direction in HSU S-IIIa is west to northwest. The saturation line for HSU S-IIIa is shown as a blue dashed line in OU-3. Figure 16 shows a groundwater flow direction in HSU S-IIIc to the southeast near the Bermite Site and northwest west of the Site. The saturation line for HSU S-IIIc is shown as a dashed blue line. And the groundwater flow direction in HSU S-Va as shown in Figure 17 is to the west and southwest.

Historically, the groundwater flow direction in the Alluvium aquifer in the Northern Alluvium area have been towards the northwest, following the Santa Clara River channel. Groundwater flow in the Saugus Formation has historically been to the west/northwest in HSU S-I and S-III.

4.2.2.2 Source Areas

The remedial investigations conducted at the Bermite Site identified areas where soil was impacted by perchlorate and VOCs, called source areas. These source areas are the primary locations where perchlorate and VOCs enter groundwater. Releases at the surface move downward first through the unsaturated zone. The unsaturated zone is the area below ground surface where the spaces between the soil particles have some water, but the spaces aren't filled. Ultimately the releases reach the water table. The water table is the top of the zone where the spaces between the soil particles are filled with water. The water below the water table is commonly called groundwater.

Based on the findings of the remedial investigations, source areas in OU-1 were identified (Figure 18). Operable Unit 1 is located on the eastern side of the Bermite Site (Figure 6). All of the areas shown on Figure 18 contained perchlorate impacted soil that required remediation. Three of these areas also contained VOCs, including PCE, TCE, 1,1-DCE, and 1,2-dichloropropane) 1,2-DCP.

Source areas were also identified in Operable Units 2 through 6 (OU-2 to OU-6) as shown on Figures 19-22. The remedial investigations identified areas with soil impacted with perchlorate and VOCs. Figure 19 shows perchlorate impacted soil areas in the 0 to 40-foot depth range within OU-2 to OU-6. Figure 20 shows perchlorate impacted soil areas in the 41 to 200-foot depth within OU-2 to OU-6. Figure 21 shows VOC impacted soil areas in the 0 to 40-foot depth

range within OU-2 to OU-6. Figure 22 shows VOC impacted soil areas in the 41 to 200-foot depth within OU-2 to OU-6.

OU-2 is located in the southeastern portion of the Site. OU-6 is an area within OU-2. The results of the remedial investigations identified several impacted areas, primarily by perchlorate, and to a lesser degree by VOCs. Almost all of the identified areas had some degree of perchlorate impact. A subset of the areas had a VOC impact. Only Areas 1 and 54 were reported to have a significant VOC impact (Figures 21 and 22). Both Area 1 and Area 54 also were impacted by perchlorate.

OU-3 is located directly north and adjacent to OU-2. The primary perchlorate source areas are Area 14 and 17, located on the far east side of OU-3. Areas 14, 17, 30 and 76 had some degree of VOC impact, but only Areas 14 and 30 indicated significant releases. Area 30 is located directly north and near Area 14.

OU-4 is located in the northwest part of the Site and forms the western boundary of the property. Perchlorate impacts were detected in the upper portion of the Hula Bowl Canyon I and the stockpiled soils in Area 16A. VOC impacts were detected only in the same area of the upper portion of the Hula Bowl Canyon I.

OU-5 is located in the northern portion of the property. OU-5 contained a number of areas impacted by perchlorate and VOCs. Most of the identified areas were impacted with both perchlorate and VOCs. Some perchlorate was detected in Area 48 (shown in the area identified as Parcel 1), however, VOCs were the primary chemical of concern detected in this area. The northernmost portion of OU-5 is called the Northern Alluvium Area. Several perchlorate source areas were identified in the Northern Alluvium Area. VOC impacts were detected in the western portion of the Northern Alluvium Area (Figure 21).

In summary, the remedial investigations identified a number of areas were soil was impacted with perchlorate and VOCs from manufacturing operations. With few exceptions, the identified areas were impacted with both perchlorate and VOCs.

4.2.2.3 Groundwater Quality

Water quality samples have been collected from the monitoring well network on a quarterly basis since 2003. The primary contaminants detected are perchlorate and VOCs, including PCE and TCE. The results of the most recent reported sampling event, the 3rd quarter 2019, are shown in Figures 23 to 29. A summary of the historical groundwater analytical results is contained in the 3rd quarter 2019 sampling report for the Bermite Site.

Perchlorate

Figures 23 to 29 show the perchlorate concentrations detected in the monitoring well network in the 3rd Quarter 2019 groundwater sampling event. Perchlorate concentrations are shown for the Alluvium Formation (Figure 23), the Undifferentiated Saugus Formation (Figure 24), the Saugus Formation HSU S-I (Figure 25), the Saugus Formation HSU S-III (Figure 26), the Saugus Formation HSU S-IIIa (Figure 27), the Saugus Formation HSU S-IIIc (Figure 28), and the Saugus Formation HSU S-Va (Figure 29).

Figure 23 summarizes the perchlorate detections in the Alluvium aquifer. Figure 23 shows perchlorate concentrations in the northern Alluvium area and shows that perchlorate has migrated in a northwesterly direction in the northern Alluvium, in the direction of groundwater flow. The perchlorate concentrations in wells AL-04A and AL-04B, located approximately 1800 feet north of Saugus 1 and Saugus 2, were 2.6 µg/L and non-detect, respectively. The perchlorate concentrations in well AL-12B, located adjacent to Saugus 1, was 2.4 µg/L.

Figure 24 summarizes the perchlorate detections in the Undifferentiated Saugus Formation. The monitoring wells in Figure 24 are located on the northern boundary of OU-5 and in the Northern Alluvium Area. The maximum perchlorate concentration detected in the Undifferentiated Saugus Formation was 1,800 µg/L in well 67-MW-02.

Figure 25 summarizes the perchlorate detections in the Saugus Formation HSU S-I. The saturation line in HSU S-I on the Bermite site is shown by the dashed blue line, meaning groundwater is not present in HSU S-I east of that line. Perchlorate concentrations measured in HSU S-I formation wells on the western boundary of the Bermite Site range from 390 to 620 µg/L.

Figure 25 summarizes the perchlorate detections in the Saugus Formation HSU S-III.

Figure 27 summarizes the perchlorate detections in the Saugus Formation HSU S-IIIa. The saturation line in HSU S-IIIa on the Bermite site is shown by the dashed blue line, meaning groundwater is not present in HSU S-IIIa east of that line. Perchlorate concentrations measured in HSU S-IIIa wells on the western boundary of the Site, closest to the Saugus 1 and Saugus 2 groundwater production wells, range from 2.3 to 84 µg/L. Monitoring well SG1-HSU3a, located approximately 500 feet east of Saugus 1, detected a perchlorate concentration of 70 µg/L. Two monitoring wells further downgradient of Saugus 1 and Saugus 2, DW-1A and DW-2, detected perchlorate at a concentration of 29 and 5 µg/L, respectively. DW-1A and DW-2 are approximately 2500 feet north of Saugus groundwater production wells V-210 and V-205.

Figure 28 summarizes the perchlorate detections in the Saugus Formation HSU S-IIIc. The saturation line in HSU S-IIIc on the Bermite site is shown by the dashed blue line, meaning groundwater is not present in HSU S-IIIc east of that line. Perchlorate concentrations measured in HSU S-IIIc wells on the western boundary of the Site, near Saugus 1 and Saugus 2 groundwater production wells, range from 53 to 84 µg/L. Well SG1-HSU3c, located closest to Saugus 1, detected perchlorate at a concentration of 0.54 µg/L. Five monitoring wells downgradient of Saugus 1 and Saugus 2 detected perchlorate concentrations from non-detect to 46 µg/L.

Figure 29 summarizes the perchlorate detections in the Saugus Formation HSU S-Va. The perchlorate concentration measured in the HSU S-Va well sampled in the recent event on the western boundary of the Site (MP-1-04), closest to the Saugus 1 and Saugus 2 groundwater production wells was 4.3 µg/L. Library Well C, downgradient of Saugus 1 and Saugus 2 detected a perchlorate concentration of 23 µg/L.

The most recent groundwater data shows that perchlorate concentrations in the Alluvium aquifer west of the Northern Alluvium Area range from non-detect to 6.5 µg/L. The maximum perchlorate concentrations of perchlorate in HSU S-I on the western boundary of OU-4 was 620 µg/L, 84 µg/L in HSU S-IIIa, and 84 µg/L in HSU S-IIIc. The 3rd Quarter results show that there is a perchlorate plume at the western boundary of OU-4 on the Bermite Site and it has migrated off-site. The highest concentrations of perchlorate in the 3rd Quarter 2019 sampling event were detected in HSU S-IIIa.

VOCs

Figures 23 to 29 also show the PCE and TCE concentrations detected in the monitoring well network in the 3rd Quarter 2019 groundwater sampling event. PCE and TCE concentrations are shown for the northern Alluvium Formation (Figure 23), the Undifferentiated Saugus Formation (Figure 24), the Saugus Formation HSU S-I (Figure 25), the Saugus Formation HSU S-III (Figure 26), the Saugus Formation HSU S-IIIa (Figure 27), the Saugus Formation HSU S-IIIc (Figure 28), the Saugus Formation HSU S-Va (Figure 29).

Figure 232 summarizes the PCE and TCE detections in the Alluvium aquifer. TCE concentrations downgradient of the western boundary of the Northern Alluvium Area range from <1.0 to 1.1 µg/L. PCE concentrations downgradient of the western boundary of the Northern Alluvium 19 Area range from 1.5 to 3.0 µg/L. TCE and PCE concentrations were non-detect in wells AL-04A and AL-04B, located north of Saugus 1.

TCA has also been detected in the Alluvium aquifer. TCA has only been detected in groundwater in the Northern Alluvium Area on the Bermite Site. The highest historical

concentration of TCA detected in the Northern Alluvium Area was 12,000 µg/L in monitoring well 75-MW-26A. TCA has been detected in Alluvium wells downgradient of the Northern Alluvium Area, including OS-MW-03A, OS-MW-02A, OS-MW-02B, AL-09A, and AL-09B. However, TCA has not been detected in Alluvium wells in the proximity of Saugus 1 and Saugus 2, including AL-04A, AL-04B, AL-12A, AL-12B, SG1-HSU1, SG1-HSU3a, SG1-HSU3b, and SG1-HSU3c.

Figure 24 summarizes the PCE and TCE detections in the Undifferentiated Saugus Formation. The monitoring wells screened in the Undifferentiated Saugus Formation are located on the northern boundary of OU-5 and in the Northern Alluvium Area. The maximum TCE and PCE concentrations detected were 710 and 13,000 µg/L.

Figure 25 summarizes the PCE and TCE detections in the Saugus Formation HSU S-I. The saturation line in HSU S-I on the Bermite site is shown by the dashed blue line, meaning groundwater is not present in HSU S-I east of that line. TCE concentrations measured in S-I formation wells on the western boundary of the Site, closest to the Saugus 1 and Saugus 2 groundwater production wells, were non-detect. The TCE and PCE concentrations in well SG1-HSU1, located close to Saugus 1, were non-detect. The groundwater flow direction in the vicinity of the western boundary of the Bermite site was determined to be in an easterly direction during the 3rd Quarter sampling event, meaning that off-site groundwater was migrating onto the Bermite Site.

Figure 26 summarized the TCE and PCE detections in the Saugus Formation HSU S-III. TCE concentrations in the RMW-04 well nest ranged from 3.1 to 210 µg/L and PCE concentrations ranged from non-detect to 24 µg/L.

Figure 27 summarizes the PCE and TCE detections in the Saugus Formation HSU S-IIIa. The saturation line in HSU S-IIIa on the Bermite Site is shown by the dashed blue line, meaning groundwater is not present in HSU S-IIIa east of that line. TCE and PCE were not detected in HSU S-IIIa wells on the western boundary of the Site, closest to the Saugus 1 and Saugus 2 groundwater production wells. Monitoring wells SG1-HSU3a and SG1-HSU3b, located close to Saugus 1, were also non-detect for TCE and PCE. Two monitoring wells further downgradient of Saugus 1 and Saugus 2, DW-1A and DW-2, were also non-detect for TCE and PCE. TCE and PCE were detected in HSU S-IIIa monitoring wells east of the western Bermite Site boundary within OU-4 (Figure 27). For example, well EW-03B detected TCE at 130 µg/L and PCE at 3.2 µg/L. Well CW-19C detected TCE at 700 µg/L and PCE at 4.9 µg/L. Well CW-21B, on the southern part of OU-4, detected TCE at 2,300 ug/. The highest concentrations of TCE and PCE were detected in HSU S-IIIa in the 3rd quarter sampling event.

Figure 28 summarizes the PCE and TCE detections in the Saugus Formation HSU S-IIIc. The saturation line in HSU S-IIIc on the Bermite Site is shown by the dashed blue line, meaning groundwater is not present in HSU S-IIIc east of that line. TCE and PCE were non-detect in S-IIIc formation wells on the western boundary of the Site, closest to the Saugus 1 and Saugus 2 groundwater production wells. HSU S-IIIc monitoring wells located further downgradient of the western boundary of the Bermite Site, west of Saugus 1 and Saugus 2, detected TCE and PCE. Library Well B detected TCE at a concentration of 1.8 µg/L, Mall Well A detected TCE at a concentration of 2.3 µg/L, and DW-1B detected TCE at a concentration of 6.2 µg/L. The only well to detect PCE downgradient of Saugus 1 and Saugus 2 was Library Well B at a concentration of 0.52 µg/L.

Figure 29 summarizes the PCE and TCE detections in the Saugus Formation HSU S-Va. TCE and PCE were non-detect in HSU S-Va wells on the western boundary of the Site, closest to the Saugus 1 and Saugus 2 groundwater production wells. All HSU S-Va wells on the Bermite Site were non-detect, except MW-05 with a TCE concentration of 14 µg/L. The only detection of TCE and PCE in HSU S-Va wells downgradient of Saugus 1 and Saugus 2 was in Library Well at concentrations of 3.0 and 0.74 µg/L.

The lack of TCE and PCE detections in wells on the western boundary of OU-4 in the 3rd quarter 2019 sampling event show that the area of groundwater impacted by TCE and PCE on the Bermite Site does not extend to or beyond the western boundary of OU-4 of the Bermite Site in HSU S-IIIa, S-IIIc, and S-Va.

4.2.2.4 Perchlorate and VOCs on the Western Boundary of OU-4

As discussed in the previous section, several wells have been constructed on the western side of OU-4 on the Bermite Site, the closest point to Saugus 1 and Saugus 2 (RMW-08A, -08B, -08C; PZ-09A, -09B; MP-1A, and MP-1-01 to MP-1-10). In addition, there are three wells located north of OU-4 that are placed between the Bermite Site and Saugus 1 and Saugus 2 (CW-01A, -01B, -01C). Well nest OS-MW-01 (A, B and C) is present south of OU-4 and west of OU-2 and OU-3. This well nest is shown on Figures 27, 28, and 29.

The groundwater data collected at the Bermite Site shows that a PCE and TCE plume has not reached the western boundary of OU-4. TCE and PCE in the monitoring wells on the western boundary of OU-4 were all non-detect in the most recent groundwater monitoring event. Figures A and B show the maximum concentration of perchlorate, TCE, and PCE detected in these wells since they were constructed.

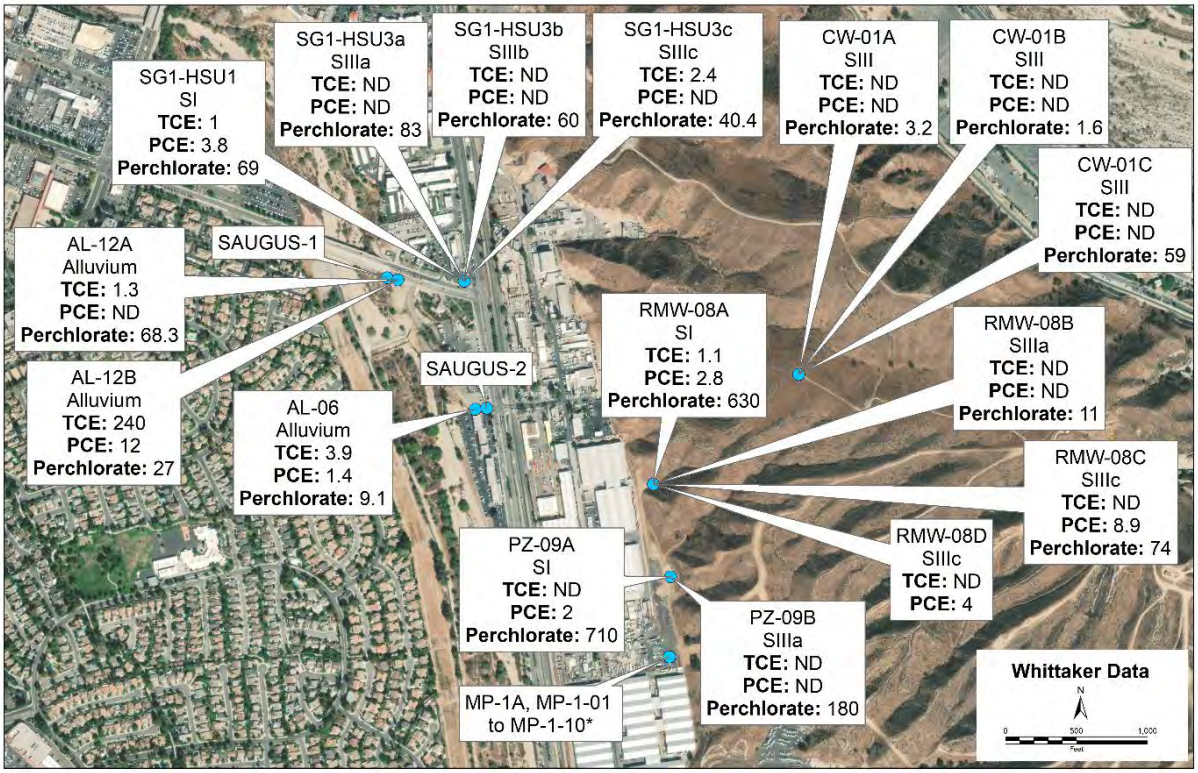

FIGURE A

Well nest RMW-08 is located on the northwest corner of OU-4 (Figure A). Well RMW-08A is screened in HSU S-I, RMW-08B in HSU S-IIIa, RMW-08C in HSU S-IIIc, and RWW-08D in HSU S-IIIc. These wells have been sampled 30 times. As shown in Figure A, the maximum perchlorate concentrations measured in RMW-08A, RMW-08B, RMW-08C, and RMW-08D are 630, 11, 74, and 81 µg/L, respectively. Perchlorate was measured in most of the sampling events. The perchlorate results from this well nest show that the perchlorate plume from the Whittaker Site has migrated to and beyond this well nest location. In other words, it shows that this location is within the migration pathway for dissolved chemicals from the source areas on the Bermite Site. PCE and TCE have been detected in three of these wells, however, only once. PCE was measured once in RMW-08A at a concentration of 2.8 µg/L, once in RMW-08C at a concentration of 8.9 µg/L, and once in RMW-08D at a concentration of 4.0 µg/L. The 29 other samples collected from these wells did not detect PCE. TCE was detected once in RMW-08A at a concentration of 1.1 µg/L and once in RMW-08D at a concentration of 2.4 µg/L. The historical non-detect results indicate that these one-time detections were spurious. The TCE and PCE results show that neither a TCE nor a PCE plume from the Whittaker Site has migrated to and beyond this well nest location.

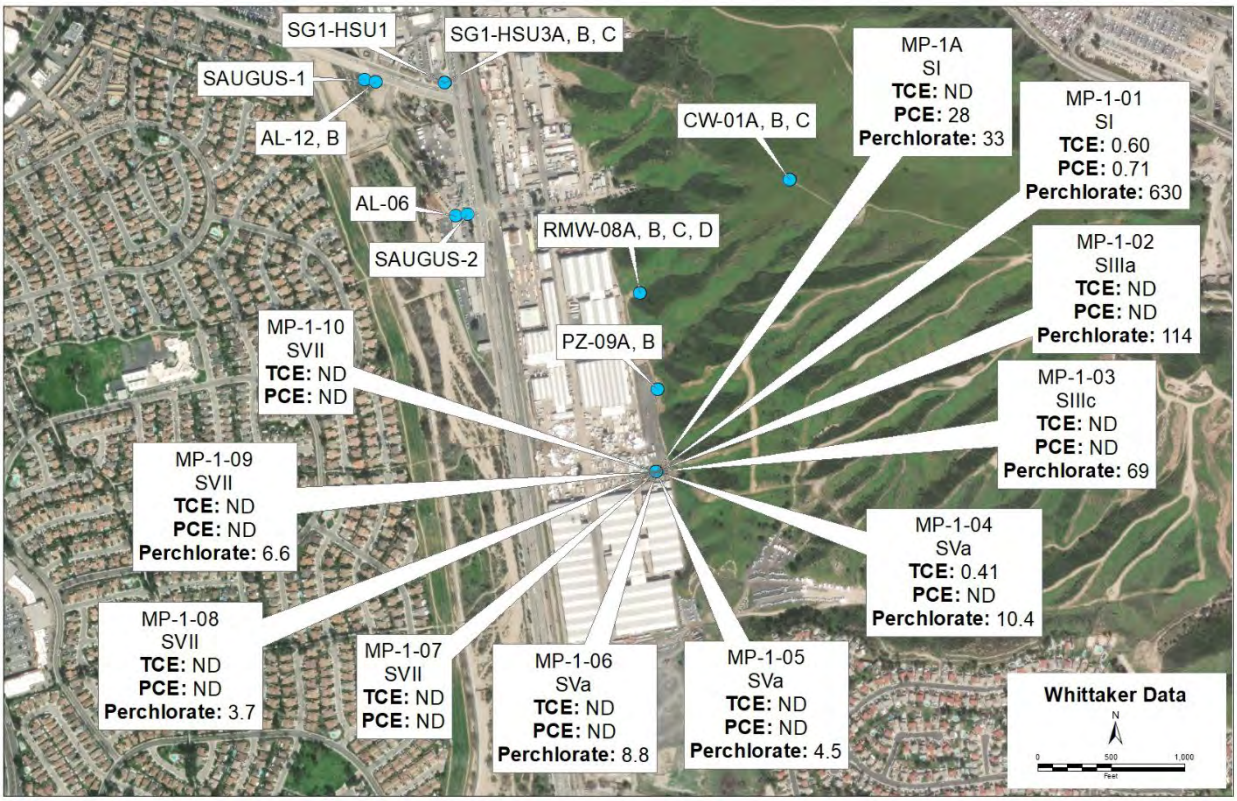

FIGURE B

Well nest PZ-09 is south of the RMW-08 well nest along the western boundary of OU-4 (Figure A). PZ-09A is screened in HSU S-I and PZ-09B is screened in HSU S-IIIa. As shown in Figure A, the maximum perchlorate concentrations measured in PZ-09A and PZ-09B are 710 and 140 µg/L, respectively. Perchlorate was detected in all but one sampling event. The perchlorate results show that the perchlorate plume from the Bermite Site has migrated to and beyond this well nest location. The maximum PCE and TCE detections in PZ-09A are 2.0 and <1.0 µg/L. PCE was detected only one time in 26 sampling events at PZ-09A. TCE was not detected in PZ-09A. The maximum PCE and TCE detections in PZ-09B are <1.0 and 1.0 µg/L. TCE was detected only once in 26 sampling events at PZ-09B. The one-time detections of PCE and TCE indicate that they are spurious and PCE and TCE impacted groundwater from the Bermite Site has not reached this location.

Well nest MP-1 is located south of well nest PZ-09 and contains 11 wells (Figure B). These wells are screened in HSU S-I, HSU S-IIIa, HSU S-IIIc, HSU S-Va, and HSU S-VII. As shown in Figure B, perchlorate has been detected in all the wells in this well nest, except the deepest well, MW-1-10. The maximum perchlorate concentrations detected in these wells ranged from 3.3 to 630 µg/L. The perchlorate results show that the perchlorate plume from the Bermite Site has

migrated to and beyond this well nest location. PCE has been detected in two of the wells, MP-1A and MP-1-01. MW-1A and MP-1-01 are screened in HSU S-I. As discussed above, the 3rd quarter 2019 water level measurements in HSU S-I show that groundwater flow is in an easterly direction, towards these wells from off-site. Water quality results are therefore not representative of groundwater from the Bermite Site. In addition, there are two wells located east of the MP-1 well nest that are screened in HSU S-I: RMW-02A and RMW-03A. PCE has been detected only once in 31 sampling events in RMW-02A. PCE has not been detected in RMW-03A in 28 sampling events. The results from RMW-02A and RMW-03A and the groundwater flow direction to the east in HSU S-I indicate that the PCE detections in MP-1A and MP-1-01 are not representative of groundwater from the Bermite Site.

TCE has been detected in two of the wells in the MP-1 well nest. TCE has been detected in MP-1-01 once in 20 sampling events at a concentration of 0.60 µg/L. TCE was detected once in 31 sampling events in MP-1-04 at a concentration of 0.41 µg/L, which is below the detection limit. These PCE and TCE results indicate that the one-time detections of PCE and TCE are spurious and the PCE and TCE plumes have not reached this well nest location.

The CW-01 well nest, located north of OU-4, is screened at different depths in HSU S-III (Figure A). All of the wells have detected perchlorate at concentrations ranging from 1.6 to 11.2 µg/L. PCE and TCE have not been detected in these wells. Water levels measured in the CW-01 well nest are higher than water levels in the RMW-04 well nest, located east of the CW-01 well nest in OU-5 (Figure 14). This indicates that groundwater flow is to the east in this area, from the CW-01 well nest towards the RMW-04 well nest in OU-5.

Well nest OS-MW-01 is located south of OU-4 and west of OU-2 and OU-3 (Figures 27, 28, and 29). These wells are downgradient of OU-2 and OU-3. Perchlorate has consistently been detected in these monitoring wells, however, PCE and TCE have been detected infrequently. Well OS-MW-01A is screened in HSU S-IIIa. The maximum PCE and TCE concentrations in OS-MW-01A were 2.1 and 8.4 µg/L. PCE was detected in this well 3 out of 66 sampling events and TCE was detected once. The continual detection of perchlorate in these wells shows that this is a flow path for contaminants from source areas on OU-2 and OU-3. The infrequent detections of PCE and TCE shows that there is not a plume of these contaminants migrating in HSU S-IIIa in this area.

Wells OS-MW-01C and OS-MW-01D are screened in HSU S-IIIc. The maximum PCE and TCE concentrations in OS-MW-01C were 3.2 and 11 µg/L. PCE was detected in this well two out of the 63 sampling events and TCE was detected three times in 63 sampling events. The maximum PCE and TCE concentrations in OS-MW-01D were 4.5 and 2.2 µg/L. PCE and TCE were detected in this well two out of 56 sampling events. The continual detection of perchlorate in these wells

shows that this is a flow path for contaminants from source areas on OU-2 and OU-3. The infrequent detections of PCE and TCE shows that there is not a plume of these contaminants migrating in HSU IIIc in this area.

In summary, the water quality data shows that dissolved perchlorate has migrated to and past the western boundary of OU-4. This shows the migration pathway for dissolved chemicals from source areas on the Bermite Site. The water quality data shows that PCE and TCE have not migrated as far as the western boundary of OU-4 (i.e. the western boundary of the main Bermite Site).

4.2.2.5 VOCs downgradient of Saugus 1

TCE and PCE have been detected in monitoring wells downgradient of Saugus 1 and Saugus 2, in the vicinity of V-201, V-205, and V-160. The highest concentrations of TCE have been detected in well DW-1B at 16 µg/L, in well Mall A at 10 µg/L, in Library Well B at 4.8 µg/L, and in Library Well C at 5.1 µg/L (Figure 7). Well DW-1B is screened in HSU S-IIIc and has detected TCE every time it has been sampled. Well Mall A is screened in HSU S-IIIc and has detected TCE every time it has been sampled. Library Well B is screened in HSU S-IIIc and has detected TCE every time it has been sampled. Library Well C is screened in HSU S-Va and has detected TCE in all but one sampling event. The concentrations of TCE are higher than concentrations detected in upgradient monitoring wells. The highest TCE concentration detected in SG1-HSU3c, screened in HSU S-IIIc, is 2.4 µg/L (Figure 7). As discussed in Section 4.2.2.4, there are several monitoring wells located on the western boundary of the Bermite Site. The water quality data collected from these wells shows that TCE is not migrating off-site from the Bermite Site. There are three monitoring wells screened in HSU S-IIIc. TCE has not been detected in any of these wells.

PCE has not been detected in SG1-HSU3c, however it has been detected in downgradient wells screened in HSU S-IIIc, including DW-1B and Library Well B.

Water Agency groundwater production wells V-201 and V-205 are located in the proximity of DW-1B, Mall Well A, Library Well B, and Library Well C. As discussed in Section 4.1.2.1 TCE has been detected in both of the groundwater production wells and PCE has not been detected.

In 2004 CH2MHill used a groundwater model to determine the capture zones for several of the Water Agency Saugus Formation production wells. The capture zones, the area where water is drawn from when a well is pumping, are shown in Figure 30. The capture zone for V-201 is in an area north and south of the well and does not include or encompass the Bermite Site. The capture zone for V-205 is also shown in Figure 30. The capture zone for V-205 shows that when the well is pumping, groundwater comes from an area north and south of the well and does not include or encompass the Bermite Site. In 2019 Kennedy Jenks used a groundwater model to

determine the capture zone for groundwater production well V-201. The capture zone is shown in Figure 31. The modeled capture zone shows that groundwater entering well V-201 when it is pumping comes from areas north and south of the well. The capture zone also shows that the four groundwater monitoring wells with TCE detections are within the area that is captured by V-201.

This data supports the presence of other potential unidentified sources in the vicinity of Water Agency groundwater production wells V-201 and V-205.

4.2.2.6 Perchlorate and VOCs from the Northern Alluvium Area

A series of monitoring wells have been constructed in the Alluvium aquifer as shown in Figure 23. Alluvium wells downgradient of the Northern Alluvium Area along the Santa Clara River include OS-MW-04A, OS-MW-04B, OS-MW-03A, OS-MW-02A, OS-MW-02B, AL-01, AL-09A, and AL-09B. Alluvium wells located along the South Fork of the Santa Clara River include AL-06, AL-12A, AL-12B, AL-04A, and AL-04B.

As discussed in Section 4.2.2.3, the most recent reported sampling event in the third quarter of 2019 shows that perchlorate is present downgradient of the Northern Alluvium Area, as shown by detections in OS-MW-03A, OS-MW-02A, and OS-MW-02B (Figure 23). TCE was detected in OS-MW-02A at a concentration of 1.1 µg/L and was non-detect in OS-MW-02B and OS-MW-03A. PCE was detected in all three of these wells at a maximum concentration of 3.0 µg/L.

In the Alluvium wells located along the South Fork of the Santa Clara River, perchlorate was detected in AL-04B and AL-12B at concentrations of 2.6 and 2.4 µg/L, respectively. TCE and PCE were not detected in AL-04A and AL-04B. PCE was not detected in AL-12B and TCE was detected at a concentration of 6.8 µg/L.

Previous sampling events show that TCE and PCE have migrated downgradient of the Northern Alluvium Area in the Alluvium aquifer. The closest downgradient Alluvium wells are OS-MW-04A and OS-MW-04B. The maximum concentration of TCE and PCE detected in OS-MW-04A were 2.4 and 1.8 µg/L. TCE was detected only twice in 31 sampling events and PCE was detected only once. The maximum concentration of TCE and PCE detected in OS-MW-04B were 2.5 and 1.5 µg/L. TCE was detected only once in 38 sampling events and PCE was detected five times in 38 sampling events.

OS-MW-03A is approximately 350 feet downgradient of the OS-MW-04 wells. The maximum concentration of TCE and PCE detected in OS-MW-03A were 19 and 150 µg/L. Wells OS-MW-02A and OS-MW-02B are approximately 400 feet downgradient of OS-MW-03A. The maximum

concentration of TCE and PCE detected in OS-MW-02A were 16 and 110 µg/L. The maximum concentration of TCE and PCE detected in OS-MW-02B were 13 and 100 µg/L.

Well AL-01 is approximately 2000 feet downgradient from the OS-MW-2 well nest. The maximum concentration of TCE and PCE detected in AL-01 were 4.1 and 58 µg/L.

Wells AL-09A and AL-09B are located approximately 1700 feet downgradient of AL-01 and approximately 2000 feet north of well nest AL-04. These wells are located in the area where the alluvium material from the Santa Clara River meets the alluvium material from the South Fork of the Santa Clara River (Figure 23). The maximum concentration of TCE and PCE detected in AL-09A were 2.5 and 5.4 µg/L. The maximum concentration of TCE and PCE detected in AL-09B were 1.7 and 2.9 µg/L.

AL-04A and AL-04B are located between the AL-09 well nest and Saugus 1 (Figure 23). The AL-04 well nest is located approximately 2000 feet upgradient of the alluvium groundwater production wells N, N7, and N8 shown on Figure 1. The maximum concentration of TCE and PCE detected in AL-04A were 150 and 20 µg/L. TCE was detected only twice in 29 sampling events. The other TCE detection was at a concentration of 1.1 µg/L. TCE in the other 27 sampling events was non-detect. PCE was detected in 11 of the 29 sampling events. The next highest PCE concentration was 3.2 µg/L. PCE has not been detected in AL-04A since 2012. The maximum concentration of TCE and PCE detected in AL-04B were 1.3 and 12 µg/L. TCE was detected only once in 46 sampling events and PCE twice.

Wells AL-12A and AL-12B are located adjacent to Saugus 1 and AL-06 is located adjacent to Saugus 2. The maximum concentration of TCE detected in AL-12A was 1.3 µg/L. TCE was detected only once in AL-12A. PCE was non-detect. The maximum concentration of TCE and PCE detected in AL-12B were 240 and 11 µg/L. TCE has been detected continuously in AL-12B. PCE was detected 11 times in 76 sampling events in AL-12B. The maximum concentration of TCE and PCE detected in AL-06 were 3.9 and 1.4 µg/L. TCE and PCE were detected 3 times in 13 sampling events.

Several alluvium groundwater production wells are located north of Saugus 1 and the AL-04 well nest and west of the AL-09 well nest (Figures 1 and 4). The alluvium groundwater production wells include N, N-7, N-8, S-6, S-7, S-8, and Q-2. In 2018 these seven alluvium groundwater production wells accounted for 31% of the total groundwater production from all 37 Water Agency groundwater production wells. Since these wells are screened in the Alluvium aquifer, the groundwater produced by these wells is from that aquifer and would draw their water from upgradient areas, including from the east towards the AL-9 well nest and the Northern Alluvium Area and south towards the AL-04 well nest.

TCA has been detected in the Alluvium aquifer in the Northern Alluvium Area on the Bermite Site. The highest historical concentration of TCA detected in the Northern Alluvium Area was 12,000 µg/L in monitoring well 75-MW-26A. TCA has been detected in Alluvium wells downgradient of the Northern Alluvium Area, including OS-MW-03A, OS-MW-02A, OS-MW-02B, AL-09A, and AL-09B. However, TCA has not been detected in Alluvium wells in the proximity of Saugus 1 and Saugus 2, including AL-04A, AL-04B, AL-12A, AL-12B, SG1-HSU1, SG1-HSU3a, SG1-HSU3b, and SG1-HSU3c. TCA has also not been detected in Saugus 1, Saugus 2, V-201 or V-205.

The Northern Alluvium Area is located north of the San Gabriel Fault (Figure 6). The San Gabriel Fault has been shown to be a barrier to groundwater flow in the Saugus Formation. VOCs in the Saugus Formation in the Northern Alluvium Area would not migrate south of the San Gabriel Fault. The Water Agency Saugus Formation groundwater production wells are located south of the San Gabriel Fault.

4.2.2.7 Remedial Action

Significant remediation of the Site has been conducted to address impacted soil, soil gas and groundwater. Remediation began at the Site in the late 1980's with the excavation of soil in OU-6 (Figure 6). A soil vapor extraction (SVE) system was operated in OU-6 from 1990 to 2002 to remediate soil gas and soil.

Soil remediation in OU-1 began in 2006 and was completed in 2010. Soil remediation in OU-5 began in October 2014 and was completed in November 2015. Remediation of soil in OU-2 through OU-4 began in September 2015 and was completed in July 2019.

SVE has been used extensively at the Site to remediate soil in OU-2 through OU-6. Sixteen SVE systems have been installed and operated at the Site starting in May 2012. Remediation with SVE was completed in April 2019.

Remediation of the Northern Alluvium Area has included in situ treatment of groundwater at the downgradient boundary, groundwater extraction in the eastern portion of the area, in-situ treatment of perchlorate and VOCs in hot spot areas, and capping of hot spot areas.

A Feasibility Study was prepared for Site groundwater in 2011 and a Remedial Action Plan was prepared in 2014. Seven extraction wells, 24 monitoring wells, and 31 piezometers were installed in HSU S-IIIa and S-IIIc between 2009 and 2011. These wells and piezometers were installed in OU-3, OU-4, and OU-5. Several of the monitoring wells could be used for groundwater extraction. The objective of the extraction system is to provide containment of

Saugus Formation VOC plume on the Bermite Site to prevent off-site migration. The groundwater extraction system began full-scale operation in 2018.

4.3 Saugus Industrial Center

The CH2MHill VOC Report concluded that the Saugus Industrial Center was considered a potential source of VOCs detected in Saugus 1 and Saugus 2. The Saugus Industrial Center is located approximately 800 feet east/northeast of Saugus 1 (Figure 32).

4.3.1 History of Operations

The Saugus Industrial Center (SIC) is located at 26000 Springbrook Avenue in Santa Clarita, California (Figure 32). SIC was formerly the Keysor Century manufacturing facility. The property is approximately 32 acres and is bordered on the west by the Southern Pacific Railroad and Bouquet Canyon Road (previously known as San Fernando Road). Undeveloped land is north and east of the property and an industrial area is present to the south. From 1958 to 2003 the property was used as a PVC processing plant that manufactured pelletized PVC for use in making vinyl discs. Raw materials used and stored at the property included TCE, vinyl chloride monomer (VCM), 1,2-DCA, vinyl chloride, vinyl acetate and toluene in an outdoor processing area to various stabilizers, defoamers and suspension agents. Chemicals were mixed in reactors to form the vinyl chloride polymer, which was used to make the PVC pellets. The USEPA reported that more than 50,000,000 pounds per year of VOCs were used as raw materials at the Site. In 1988 alone, 300,000 pounds of TCE were used at the Site.

Six aboveground storage tanks were present on the Site in 1988. The tanks were located in the outdoor production area. The tanks included:

a. 11,200 gallons, vinyl chloride monomer
b. 8,600 gallons, vinyl chloride monomer
c. 20,000 gallons, vinyl acetate monomer
d. 7,500 gallons, TCE
e. 4,400 gallons, vinyl chloride monomer recovery
f. 1,200 gallons, vinyl acetate monomer recovery

In a Phase I Environmental Site Assessment conducted in 2000 the site inspection identified 13 aboveground storage tanks on the Site.

Wastewater generated from production was discharged to an unlined pond on the far eastern portion of the property beginning in 1958 (Figure 32). The wastewater contained TCE and other chemicals used in the manufacturing process. The facility began discharging some of the wastewater to the local sewer system in 1963. Wastewater was discharged to the unlined pond after 1963. In January 1974 Los Angeles County ordered Keysor to stop wastewater discharges

to the unlined pond. At this time, Keysor was reportedly discharging some wastewater to an unlined drainage channel located adjacent to the plant along the Southern Pacific Railroad right of way. The unlined drainage channel was in the front of the plant along the railroad right of way and drained to the South Fork of the Santa Clara River. Although Keysor was ordered in January 1974 to cease discharging wastewater to the unlined channel, they were cited for this activity in October 1974 and December 1977. The Los Angeles County Engineer conducted an inspection in November 1976 and discovered that Keysor was still using the unlined pond for wastewater discharge. In addition, the inspection observed wastewater being discharged to the slopes surrounding the pond. By October 1977 the unlined pond had been removed.

Numerous spills and releases of chemicals were reported during the operation of the facility. For example, USEPA reports that in 2002 numerous spills were reported. Process water and wastewater containing TCE, vinyl chloride, and vinyl acetate had been released in amounts ranging from 100 to 1000 gallons.

On December 18, 2003, Saugus Industrial Center, LLC took ownership and control of the property, which it had purchased through a bankruptcy court sale. Prior to the purchase, SIC's consultant RAMCO Environmental, LLC (RAMCO) prepared a Preliminary Environmental Assessment (PEA) report for the SIC Site. RAMCO stated that the PEA was formatted to ASTM E-1527-00, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process. Photographs taken during the PEA site visit are in Exhibit E and show storage tanks, drums, sumps, reactors and the former wastewater pond.

On September 25, 2003 RAMCO conducted a soil vapor survey in the process area at the Site. Soil samples were collected in the process area on October 8, 2003. Limited shallow soil sampling (to a depth of 18 inches) was conducted by RAMCO on the Site in May, after SIC had assumed ownership and control of the Site, near the warehouse and compounding plant building (where the dry finished PVC was handled). RAMCO also collected soil samples at three locations in the former wastewater treatment area in December 2004.

Beginning in October 2003 Keysor began demolishing and removing the chemical manufacturing equipment and hazardous materials. This activity continued to approximately May to June 2004 by which time SIC had already owned the property for four months, having assumed ownership and control of the property on December 18, 2003. During the period from October 2003 continuing to approximately May to June 2004 an incinerator, chemical storage tanks, reactors, polymer bins, loading silos, drums, wastewater tanks, and the monomer recovery tower were removed. Hazardous waste manifests show that solid and liquid non-RCRA hazardous waste were removed from the Site during this same period. Thousands of gallons of PVC resin were removed from tanks at the Site in January 2004 soon after SIC had assumed ownership and control. Liquids from rinsing tanks and from drums on the Site were also removed during this time. A January 21, 2004 hazardous waste manifest included TCE from two 55-gallon drums.

In April and May 2004, nine sumps that contained wastewater from the manufacturing process were excavated and removed from the Site. Prior to their removal, 4000 gallons of accumulated water was removed from the sumps. The water was analyzed and found to contain several VOCs, including TCE. All underground industrial wastewater lines into and out of the sumps were washed and then plugged in place at the exterior wall of the sump. Transmission lines to the wastewater treatment area were cut and the lines were plugged at each open end.

The USEPA issued its Expanded Site Inspection Report for the SIC Site in January 2006. The purpose of the Expanded Site Inspection was to assess the relative threat associated with actual or potential releases of hazardous substances to the environment. Five groundwater monitoring wells were installed and sampled and 60 soil samples at 15 locations were collected. Photographs taken on April 21, 2004 during the Expanded Site Inspection showing the manufacturing equipment left on-site by Keysor are provided in Exhibit F. Based on the findings of the Expanded Site Inspection USEPA concluded that the Site warranted further assessment by either USEPA or DTSC. DTSC assumed the position as the lead agency for the Site soon thereafter.

SIC entered into a Voluntary Cleanup Agreement (VCA) with DTSC in October 2007, 22 months after USEPA concluded that further assessment was warranted and almost four years after taking ownership and control of the Site. The VCA contained a schedule for the site characterization (i.e. investigation) and remediation of the Site. Site characterization was to be completed approximately one year after execution of the VCA, in October 2008. Remediation of the Site was scheduled to begin six months after completion of the site characterization, in April 2009.

Five new groundwater monitoring wells were installed by RAMCO in October 2008 one year after signing the VCA and nearly five years after SIC took ownership and control of the Site. The five groundwater monitoring wells installed by USEPA at the Site in 2004 during USEPA's Expanded Site Inspection and the five new wells installed by RAMCO were sampled by RAMCO in October 2008.

An initial soil vapor investigation was conducted by RAMCO in November 2008.

Site characterization continued following the 2008 initial sampling. The investigations developed information on the geology, hydrogeology, and contamination at the SIC Site. Site characterization of the SIC Site was completed in 2014, seven years after the VCA and ten years after SIC assumed ownership and control of the Site. However, characterization of off-site groundwater contamination, which has migrated from the Site has not been completed as of August 2020. Based on the information collected during the site characterization a soil vapor

extraction system was installed and began operation in April 2016, almost nine years after the VCA and 12 years after SIC assumed ownership and control of the property. An in-situ groundwater remediation program was initiated at the Site in January 2017. According to Jose Diaz, the DTSC project manager of this Site, groundwater contamination from releases at the Site has not been remediated to DTSC's satisfaction and continues to migrate off the Site.

4.3.2 Remedial Investigations and Remedial Action

Remedial investigation of the Site by SIC was initiated in 2009. A series of investigations were subsequently conducted involving the collection of soil, soil gas and groundwater samples. The following paragraphs provide a summary of the results of the investigations.

Geology

The SIC Site is underlain by three geologic formations: alluvium sediments, older surficial sediments, and the Saugus Formation. The alluvium sediments are the uppermost formation and were deposited primarily by the South Fork of the Santa Clara River. The alluvium sediments at the Site are primarily comprised of sand, gravel, and boulders and vary in thickness from approximately ten feet on the eastern portion to over 90 feet on the western portion, as reported in 2011 by RAMCO, SIC's consultant.

The older surficial sediments are beneath the alluvium sediments and are generally comprised of material that was eroded from upland areas, primarily gravel and sand. These older surficial sediments have been subsequently eroded and are missing over much of the Site.

The Saugus Formation underlies both the alluvium and older surficial sediments. Because the older surficial sediments are not present over much of the Site, the Saugus Formation is in direct contact with the alluvium sediments. The Saugus Formation is composed of conglomerate, sandstone, and siltstone. However, the upper surface of the Saugus Formation at the SIC Site is generally unconsolidated and porous, easily transmitting groundwater.

In addition to geologic formations at the Site, there is also evidence of faulting. The San Gabriel Fault, the major fault in the area, is present north of the SIC Site. The Holser Fault is associated with the San Gabriel fault and cuts across the SIC Site in a southeast to northwest direction (Figure 33). The Holser Fault is a reverse fault that is steeply inclined to the south/southwest and crosscuts the Saugus Formation. There is evidence that the fault is exposed in the canyon walls adjacent to the SIC Site in outcropping Saugus Formation.

The faulting at and near the SIC Site has caused the Saugus Formation, which was originally horizontal, to deform and dip to the southwest. The Saugus Formation at the SIC Site has been

mapped by RAMCO and Dibblee as dipping 50 to 60 degrees to the south/southwest. Figure 34 shows a portion of the Dibblee geologic map in the area where the SIC Site is located and shows the steep 60-degree dipping angle of the Saugus Formation in a southwest direction. Figure 33 shows the location of the cross sections by SIC's consultant RAMCO. Figure 35 is a northeast/southwest cross section that shows the steeply dipping Saugus Formation (labeled QTs on the Figure). Figure 36 is an east/west cross section that also shows the steeply dipping Saugus Formation beneath the SIC Site. The Saugus Formation is approximately 60 feet below ground surface on the western boundary of the Site on Figure 36. Figure 37 is a cross section that trends slightly southeast to northwest. It shows the alluvium sediments (labeled Qal) approximately 150 feet thick at the Site boundary at the end of the cross section. Further away from the fault zone the Saugus Formation transitions from the 60 degree dip at the SIC Site to the regional dip between 10 to 15 degrees.

Hydrogeology

Groundwater monitoring wells have been installed at the SIC Site to measure water levels and to collect groundwater samples. A total of 18 monitoring wells have been installed. Figure C shows the locations and screen intervals of the wells below ground surface. Thirteen shallow monitoring wells (MW-1 to MW-12 and MW-13A) were screened to intersect the water table. These monitoring wells vary between 70 and 105.7 feet deep. All of these wells went dry between 2012 and 2015 as the water table in the area lowered. Five monitoring wells (MW-1B, 4B, 13B, 14 and 15) were screened deeper in the aquifer and did not go dry. These monitoring wells vary between 125 and 180 feet deep. Thirteen vapor extraction wells (VE-1 to VE-13) were installed at the Site in 2016 and 2017. Water levels and groundwater samples have been collected from these wells.

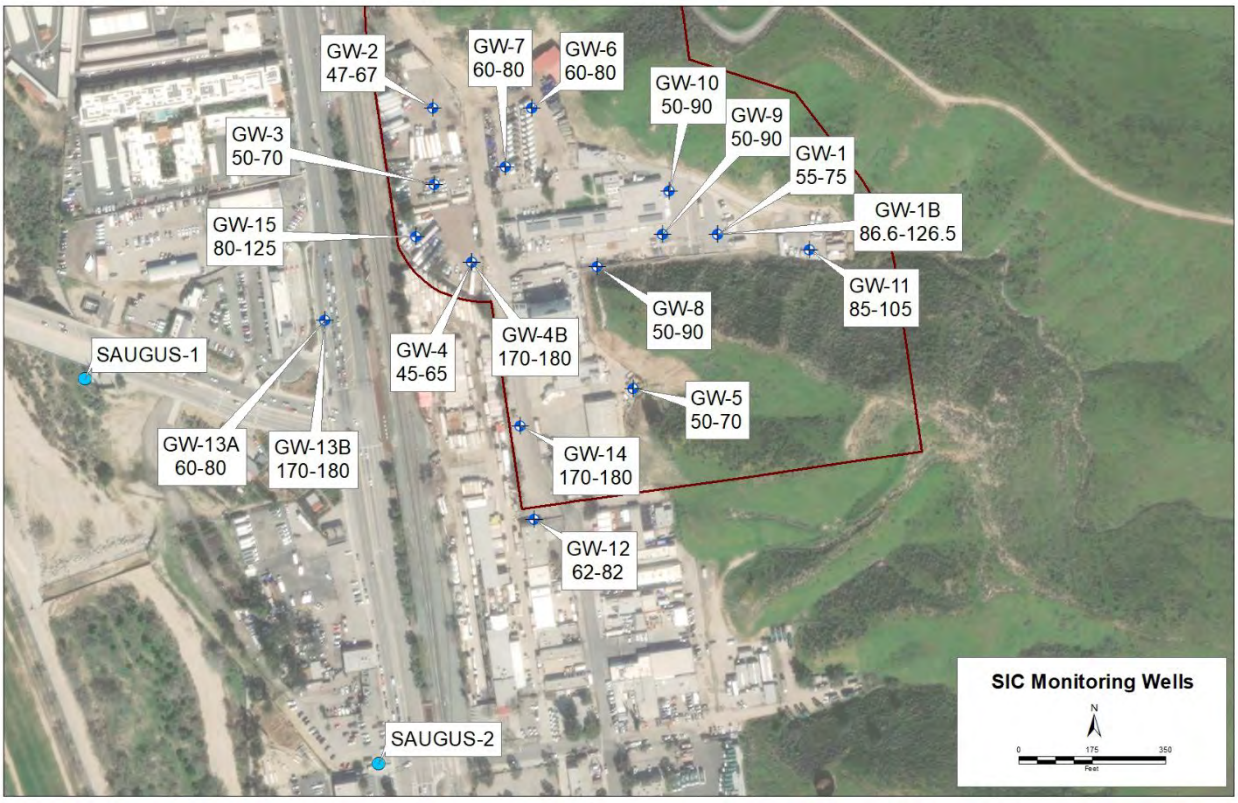

FIGURE C

The thickness of the alluvium sediments varies on the Site from approximately ten to more than 90 feet. The Saugus Formation is directly under the alluvium sediments on the Site and these formations are in direct hydraulic connection. Over half of the 18 groundwater monitoring wells at the Site are screened in the Saugus Formation. Currently the water table is present in the Saugus Formation over most of the Site.

Water table contour maps were generated for the shallow groundwater well network until the shallow wells went dry, due to a lowering of the water table. Water levels could only be measured in the five deeper wells after the shallow wells went dry. Based on the water level measurements in the shallow wells, the groundwater flow direction was variable during the period they were measured from 2008 to 2013.

In several of the water table contour maps the shallow water table shows mounding under the Site and indicates shallow groundwater flow on the east side of the Site is in a northeast direction and flow on the west side of the Site is west to southwest. This mounding is shown in the water table contour maps in RAMCO's 2011, 2012, and 2013 reports. As shown in the water table contour map for the third quarter of 2012 groundwater flow is highly variable. On

the east side of the Site groundwater flow is shown in a northeast direction (Figure 38). Groundwater flow on the west side of the Site varies from northwest to west/southwest, towards the SCVWA groundwater production wells Saugus 1 and Saugus 2. Similarly, in the water table contour map for the second quarter of 2013 groundwater flow on the east side of the Site is shown in a northeasterly direction and groundwater flow on the west side of the Site is shown in a southwest direction (Figure 39). The mounding shown on the water table contour maps may be due to the unique geology at the Site, including the faulting and the severely dipping Saugus Formation. The groundwater divide shown on Figures 38 and 39 (where the groundwater flow direction goes in opposite directions) is shown as southeast to northwest on the Site. The location of the groundwater divide may be related to the location of the Holser Fault on the Site, which also is in a southeast to northwest direction on the Site (Figure 33).

Groundwater contour maps were also generated using some of the wells screened below the water table. The groundwater flow direction using these deeper wells shows considerable variability. The predominant flow direction appears to be to the northwest (Figure 40). The northwest flow direction in these deeper wells is in the direction of Alluvium monitoring wells AL-04A and AL-04B and the alluvium groundwater production wells N, N7, and N8.

Groundwater Quality

Groundwater samples have been collected from the groundwater monitoring wells since 2008. The primary constituents detected in groundwater at the Site are TCE, chloroform, 1,2-DCA, PCE, VC, cis-1,2-DCE, methyl ethyl ketone, methyl isobutyl ketone, acetone, and toluene.

The groundwater quality results for the most recent reported sampling event, the 1st quarter 2020, are shown in Figure 41. In the 1st quarter 2020 the highest TCE concentrations were detected in wells GW-15 and GW-4B, located southeast of GW-15. Both wells are located on the western boundary of the SIC Site. GW-15 is 125 feet deep and GW-4B is 180 feet deep. The TCE concentration detected in GW-15 was 480 µg/L and 210 µg/L in GW-4B. TCE was detected in GW-13B at a concentration of 3.1 µg/L. Monitoring well GW-13B is located west of the SIC Site across Bouquet Canyon Road. It is approximately 500 feet east/northeast of Saugus 1. PCE was not detected in the 1st quarter 2020.

The highest concentration of 1,2-DCA was detected in well VE-9, located in the eastern portion of the SIC Site, at a concentration of 84,000 µg/L. Wells GW-13B, GW-4B and GW-15 did not detect 1,2-dichloroethane. Chloroform was detected in four wells, GW-4B, GW-8, GW-14 and GW-15 at concentrations from 18 and 310 up/L. VC was detected in two wells, VE-7 and VE-8, at a concentration of 8.8 µg/L and 1 µg/L, respectively.

Figures D to H show the maximum concentrations of TCE, chloroform, PCE, 1,2-DCA and vinyl chloride that have been detected at the Site in the GW series wells since groundwater monitoring began in 2008.

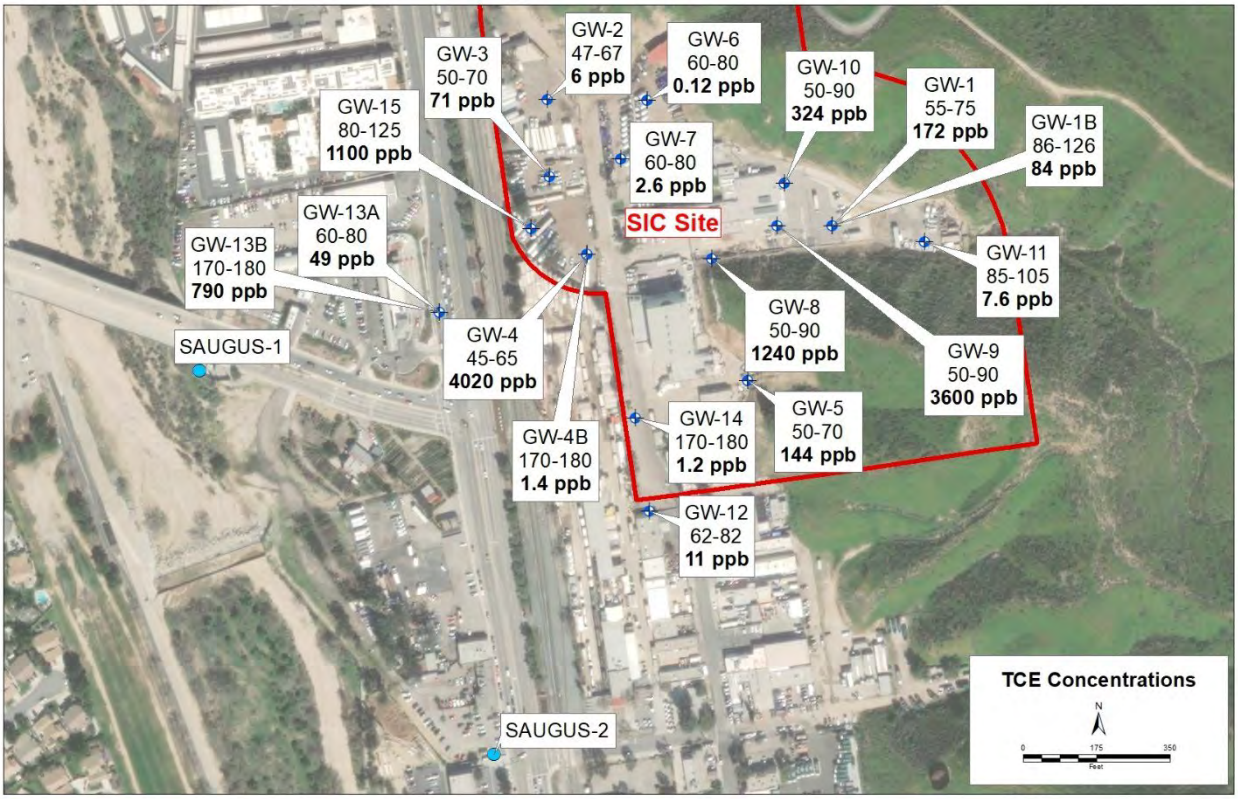

FIGURE D

Figure D shows the maximum TCE concentrations at the SIC Site. Maximum TCE concentrations have ranged from 0.12 to 4,020 µg/L. TCE has been detected at the SIC Site at a maximum concentration of 4020 µg/L in shallow well GW-4 and 1100 µg/L in deep well GW-15 near the western boundary. The closest monitoring wells to Saugus 1 and Saugus 2, GW-13 and GW-13B, show maximum TCE concentrations of 49 and 790 µg/L, respectively. TCE has been detected all 29 sampling events in GW-13B.

As discussed in the Hydrogeology section over half of the 18 groundwater monitoring wells at the Site are screened in the Saugus Formation. All of these wells have detected TCE.

The extent of the TCE contaminated groundwater from the SIC Site has not been characterized. First, the vertical extent of the TCE contamination has not been determined. The highest concentrations of TCE detected at the Site are in deep wells. No monitoring wells have been

constructed deeper than these wells to determine the vertical extent of the TCE contaminated groundwater. In addition, the horizontal extent of the TCE contaminated groundwater from the Site has not been characterized. The highest TCE concentrations have been detected in wells located near the boundary of the Site. TCE contaminated groundwater has migrated off-site. The only SIC monitoring wells located off-site are GW-13A and GW-13B (Figure D). TCE has been detected in both of these wells.

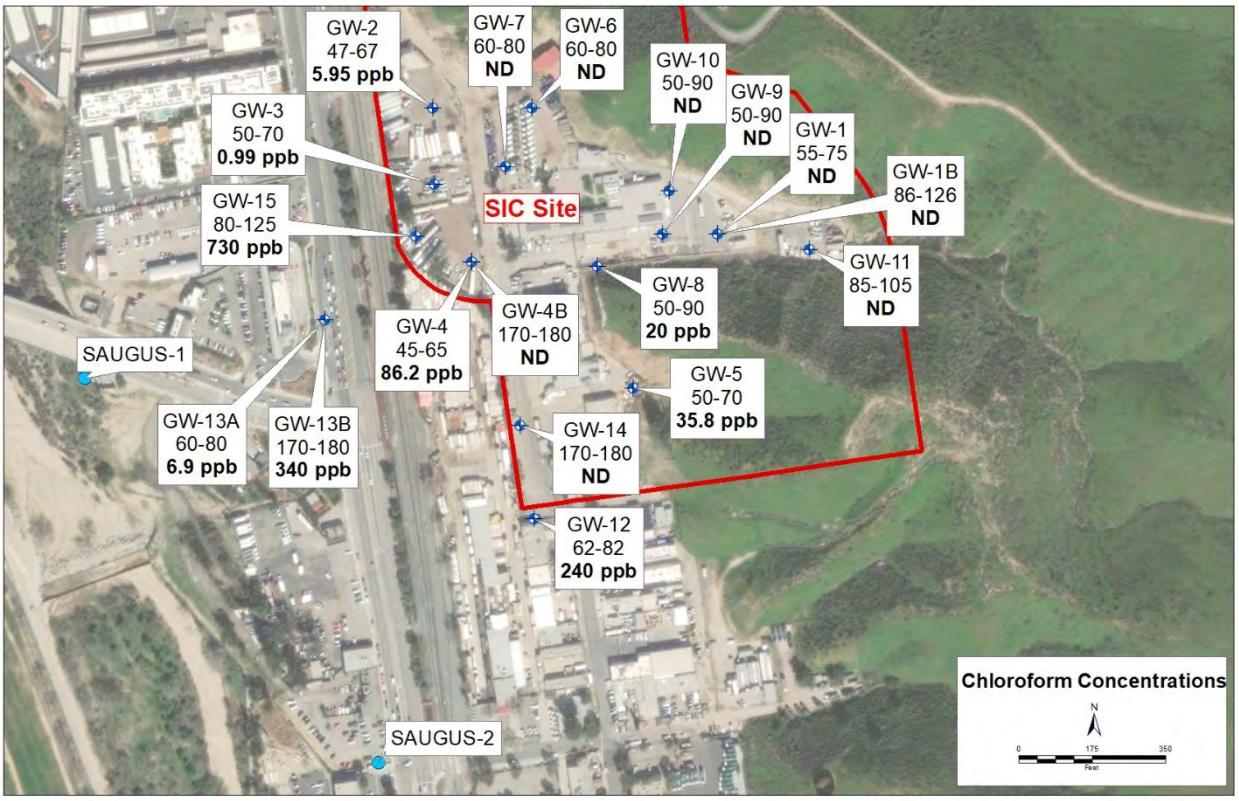

FIGURE E

Figure E shows the maximum chloroform concentrations at the SIC Site. Maximum chloroform concentrations have ranged from non-detect to 730 µg/L (GW-15). The closest monitoring wells to Saugus 1 and Saugus 2, GW-13A and GW-13B, show maximum chloroform concentrations of 6.9 and 340 µg/L, respectively. Chloroform has been detected all 29 sampling events in GW-13B.

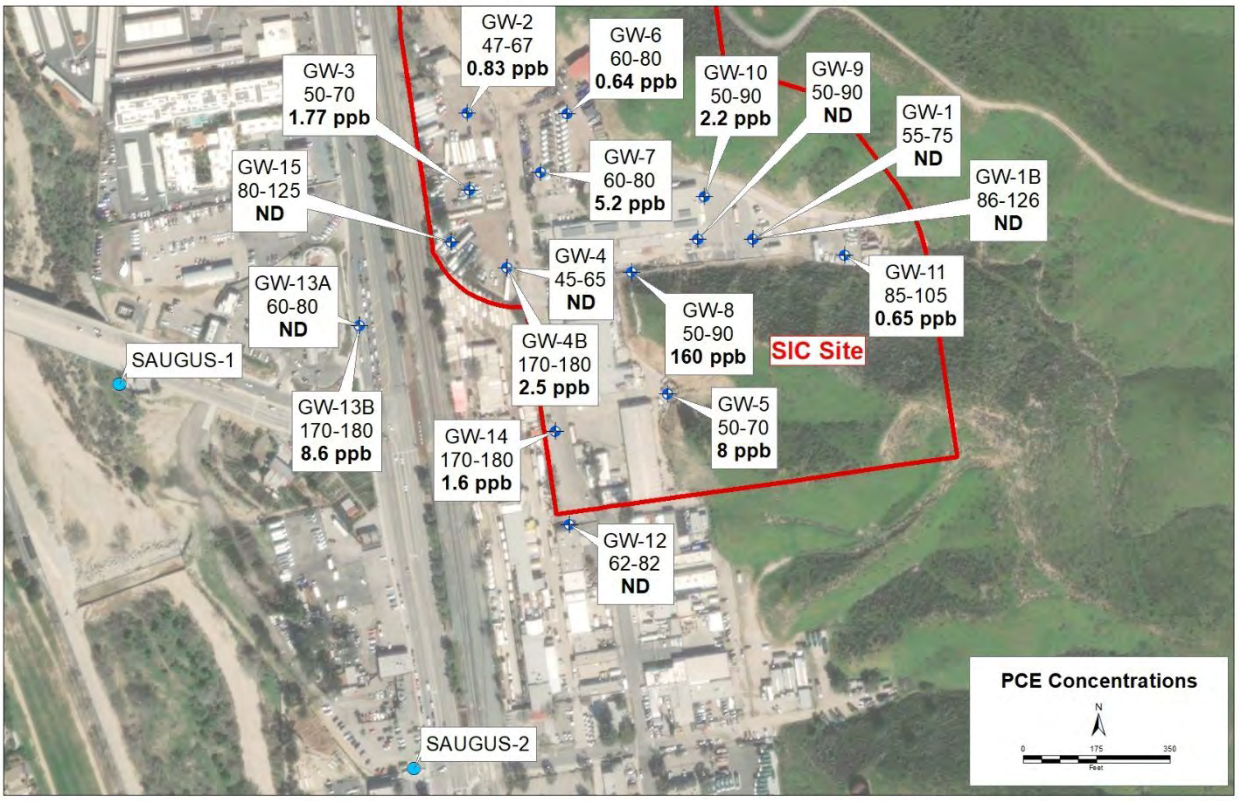

FIGURE F

Figure F shows the maximum PCE concentrations at the SIC Site. Maximum PCE concentrations have ranged from non-detect to 160 µg/L (GW-8). The closest monitoring wells to Saugus 1 and Saugus 2, GW-13A and GW-13B, show maximum PCE concentrations of non-detect and 8.6 µg/L, respectively. PCE has been detected 4 times in 29 sampling events in GW-13B.

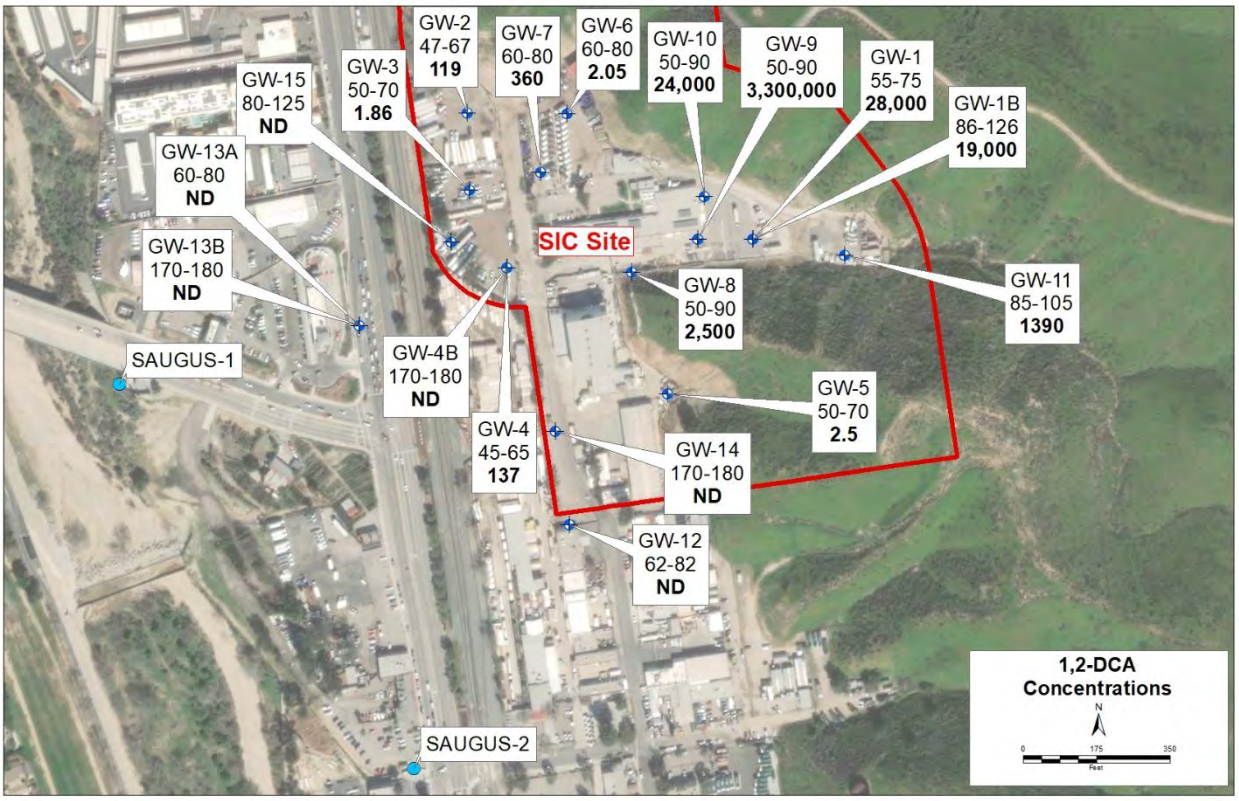

FIGURE G

Figure G shows the maximum 1,2-DCA concentrations at the SIC Site. Maximum 1,2-DCA concentrations have ranged from non-detect to 3,300,000 µg/L (GW-9). 1,2-DCA has not been detected in deep wells GW-4B and GW-15 on the western side of the Site. 1,2-DCA has also not been detected in GW-13A and GW-13B, the closest monitoring wells to Saugus 1 and Saugus 2.

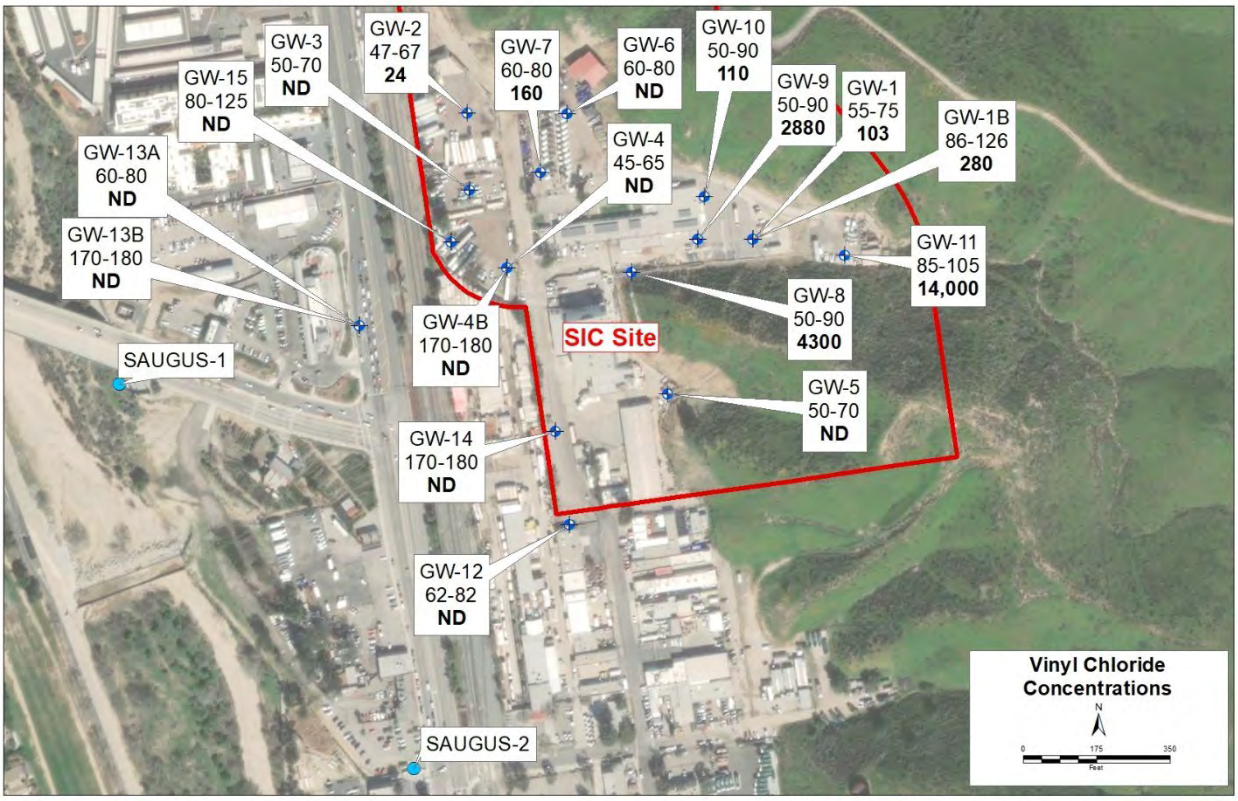

FIGURE H

Figure H shows the maximum vinyl chloride concentrations at the SIC Site. Maximum vinyl chloride concentrations have ranged from non-detect to 14,000 µg/L (GW-11). Vinyl chloride has not been detected in deep wells GW-4B and GW-15 on the western side of the Site. Vinyl chloride has also not been detected in GW-13A and GW-13B, the closest monitoring wells to Saugus 1 and Saugus 2.

Remedial Action

Based on the results of the soil and soil vapor sampling at the SIC Site, a soil vapor extraction system was installed and began operation in April 2016.

An in-situ groundwater remediation program was initiated at the SIC Site in January 2017 to address on-site groundwater contamination. An Emulsified Vegetable Oil (EVO) substrate and microbial suspension was injected into VE-1, VE-2, VE-3, and VE-4 to promote biodegradation of the COCs. In July 2018 another injection was made in VE-5, VE-6, VE-7, VE-8, VE-9, VE-10, and VE-11.

4.4 Water Quality Near Saugus 1 and Saugus 2

Several wells have been constructed in the vicinity of Saugus 1 and Saugus 2 to act as early detection wells, or sentry wells. These wells monitor the water quality adjacent to or upgradient of the groundwater production wells. These wells include AL-06 (adjacent to Saugus 2), AL-12A and AL-12B (adjacent to Saugus 1), and the well nest SG1-HSU located approximately 500 feet east of Saugus 1 between the SIC Site and Saugus 1. Wells AL-06, AL-12, and AL-12A are all screened in the Alluvium aquifer. Well SG1-HSU1 is screened in HSU S-I, SG1-HSU3a in HSU S-IIIa, SG1-HSU3b in HSU S-IIIb, and SG1-HSU3c in HSU S-IIIc. Figure I shows the maximum concentrations of TCE, PCE, and chloroform in the shallow sentry wells AL-06, AL-12A, AL-12B, and SG1-HSU1 and five SIC wells, including SIC monitoring wells GW-4, GW-4B, and GW-15 on the western side of the SIC Site and GW-13A and GW-13B west of the SIC Site across Bouquet Canyon Road. Figure I also shows maximum TCE and PCE concentrations detected in wells SG1-HSU3a, SG1-HSU3b, and SG1-HSU3c.

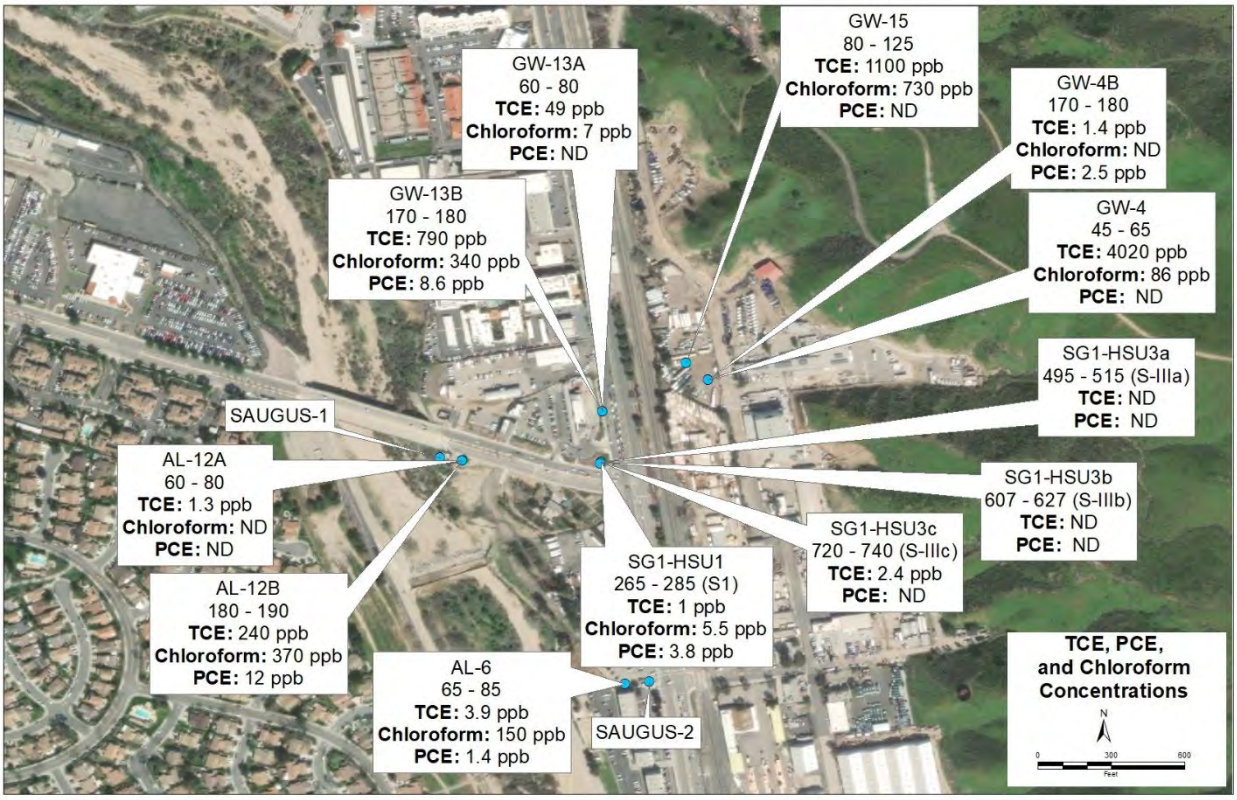

FIGURE I

The SG1-HSU well nest was specifically constructed by the Water Agency to monitor Saugus Formation water quality upgradient of Saugus 1. The deeper sentry wells in the SG1-HSU well nest are monitoring water quality in HSU S-IIIa, S-IIIb, and S-IIIc.

In the most recent sampling event TCE and PCE were non-detect in all four wells in the SGU1-HSU well nest. Since this well nest has been sampled, TCE and PCE have been detected in SG1-HSU1 at maximum concentrations of 1.0 µg/L and 3.8 µg/L, respectively. TCE and PCE has been detected in this well only two times in 71 sampling events, indicating that there is not a TCE or PCE plume that is migrating in the S-I formation at this location. TCE and PCE have not been detected in SG1-HSU3a or SG1-HSU3b in any sampling event. TCE has been detected at a maximum concentration in SG1-HSU3c of 2.4 µg/L and PCE has not been detected. TCE has been detected in half the sampling events in SG1-HSU3c. Mr. Lechler testified that he could not conclude that the TCE detections in SG1-HSU3c came from the Whittaker Site.

TCE has been detected at the SIC Site at a maximum concentration of 4020 µg/L in shallow well GW-4 and 1100 µg/L in deep well GW-15 near the western boundary (Figure I). TCE has been detected in both off-site monitoring wells, GW-13A and GW-13B, on the west side of Bouquet Canyon Road, approximately 300 feet southwest of the SIC Site. GW-13A is 80 feet deep and GW-13B is 180 feet deep. The maximum concentration of TCE detected in GW-13A was 49 µg/L and 790 µg/L in GW-13B. Groundwater monitoring well AL-12B is located approximately 500 feet southwest of GW-13B. AL-12B is located adjacent to one of the Santa Clarita Valley Water Agency groundwater production wells, Saugus 1. Monitoring well AL-12B is 180 feet deep. The maximum TCE concentration detected in AL-12B is 240 µg/L. TCE has been detected in AL-12B in all 76 sampling events.

Chloroform has also been detected in SIC wells and in AL-12B. The maximum chloroform concentration detected at the SIC Site was 730 µg/L in GW-15 (Figure I). Chloroform was detected at a maximum concentration of 340 µg/L in GW-13B and 370 µg/L in AL-12B.

Based on the data collected from SIC monitoring wells and AL-12B, TCE and chloroform have migrated from the SIC Site to the AL-12B location, adjacent to Saugus 1. TCE and chloroform have also been detected in Saugus 1 and Saugus 2.

4.5 Other Potential Sources of TCE and PCE

As discussed in Section 4.1.4, the Water Agency retained CH2MHill to conduct an evaluation of potential sources of VOCs impacting groundwater production wells. CH2MHill evaluated known

clean-up sites within a search area defined by groundwater modeling of the capture zones of Saugus 1 and Saugus 2 and concluded that there were only two potential sources, the Bermite Facility and the Saugus Industrial Center. CH2MHill limited their evaluation to sites identified on the Water Board or DTSC websites that were within the modeled search area. They did not evaluate potential sources that were outside the search area. They also did not consider sites that were not identified on these websites (potentially contaminated sites that had not been previously identified by either the Water Board or DTSC). In addition, they eliminated as potential sources sites that had inadequate information to determine if they could have released TCE or PCE.

TCE and PCE have been detected in monitoring wells downgradient of Saugus 1 and Saugus 2, in the vicinity of V-201 and V-205 as discussed in Section 4.2.2.5. The capture zones for V-201 and V-205 were determined using a groundwater model (Figure 30).

The following Sites are other potential sources of TCE and PCE that are located within the capture zones of the Water Agency Saugus Formation production wells. The Sites were identified on the Water Board and DTSC websites, EDR City Directories, and the work of Archaeological/Historical Consultants:

DRY CLEANERS

There are a number of dry cleaners in the vicinity of the Water Agency groundwater production wells. Dry cleaners have historically used PCE as the primary cleaning solvent. Releases of PCE from dry cleaners is common in California. Dry cleaners have been found to release PCE in wastewater and as pure product. PCE as a pure product is known as a Dense Non-Aqueous Phase Liquid (DNAPL). A DNAPL is heaver that water.

Several of the following dry cleaners have had some environmental investigation, however most haven't.

Le Val Cleaners, 25859 Railroad Avenue, Santa Clarita. Le Val Cleaners was identified in a City Directory as being located at 25859 Railroad Avenue in 1967 (Railroad Avenue is the southern extension of Bouquet Canyon Road). Le Val Cleaners was located in the vicinity of the Saugus 2 groundwater production well. No environmental investigation has been conducted on the Le Val Cleaners Site.

Flamingo Cleaners, 26512 Bouquet Canyon Road, Santa Clarita. Flamingo Cleaners is located northeast of Saugus 1 and Saugus 2. The dry cleaner operated from approximately 1989 to 2007. The dry cleaner impacted soil, soil gas and groundwater with PCE and TCE. Water level measurements in monitoring wells show that groundwater flows to the southwest, in the direction of Saugus 1 and Saugus 2. A Flamingo Cleaners monitoring well located

downgradient, southwest of the Site, detected a PCE concentration of 150 µg/L. Mr. James Leserman, from the Santa Clarita Valley Water Agency, testified that detections of PCE at a turnout in their water distribution system could have come from Flamingo Cleaners.

Dry Cleaners at Granary Square/Magic Cleaners, 25840 McBean Parkway, Santa Clarita. The Dry Cleaners at Granary Square operated from approximately 1986 to 2019. Soil and soil gas investigations were conducted at the Site. A SVE system was operated to address PCE impacted soil and soil gas. It appears than no groundwater investigation was conducted at the Site.

The English Cleaners/Flamingo Cleaners/Valencia Cleaners, 23360 Valencia Blvd, Valencia. This dry cleaner operated from 1994 to the present.

Glory Cleaners, 23142 Valencia Blvd, Valencia. This dry cleaner operated from approximately 1995 to 2014.

Bouquet 2 Cleaners/Valencia Cleaners, 24214 Valencia Blvd, Valencia. This dry cleaner operated from approximately 2008 to at least 2012.

Flair Cleaners, 27011 McBean Parkway, Valencia. This dry cleaner operated from approximately 2002 to 2020.

Bouquet Cleaners/Town Center Drive Cleaners, 24510 Town Center Drive, Valencia. This dry cleaner operated from approximately 2001 to the present.

Village Cleaners, 25864 Tournament Road, Valencia. This dry cleaner operated from approximately 1994 to 2019.

AUTOMOTIVE BUSINESSES

Several automotive businesses were located in the vicinity of the Water Agency groundwater production wells. These businesses were known to have used PCE and/or TCE.

Magic Lincoln Mercury, 24135 Creekside Road, Valencia. Listed as a small quantity generator of PCE in 2000.

Saturn of Santa Clarita, 23645 Creekside Road, Santa Clarita. Listed as a handler of PCE and TCE in 1998.

Big O Tires, 23510 Valencia Blvd, Valencia. Listed as a small quantity generator of PCE and TCE in 2000.

Penske Truck Leasing Co, 23740 West Magic Mountain Parkway, Valencia. Listed as a handler of PCE and TCE in 2018.

OTHER POTENTIAL SOURCES

Thatcher Glass Manufacturing Company. The Thatcher Glass Manufacturing Company (Thatcher Glass) was located at 25655 Springbrook Avenue, approximately 2000 feet south/southeast of Saugus 2 (Figure J). Thatcher Glass operated as a glass manufacturing facility from 1954 to 1985. The Site was identified in 1998 by USEPA as a potential Superfund site with VOCs as one of the principal contaminants. Some soil removal was reportedly conducted at the Site, however, no groundwater investigation was conducted. Thatcher Glass is within the modeled search area used by CH2MHill.

FIGURE J

Saugus Intermediate Field/Newhall Airport. An airport was previously located southeast of Saugus 1 and Saugus 2 (Figure K). It was established in 1928-1929 and was shut down in 1949 but was used for emergency landings until at least 1964. From March 1932 to October 1933 approximately 1177 planes landed at the airport. It was used by commercial aircraft and also by the military during World War II. It is possible that solvents, such as TCE, were used at the airport in the maintenance and repair of planes. It appears that no environmental investigation of the Newhall Airport has been conducted.

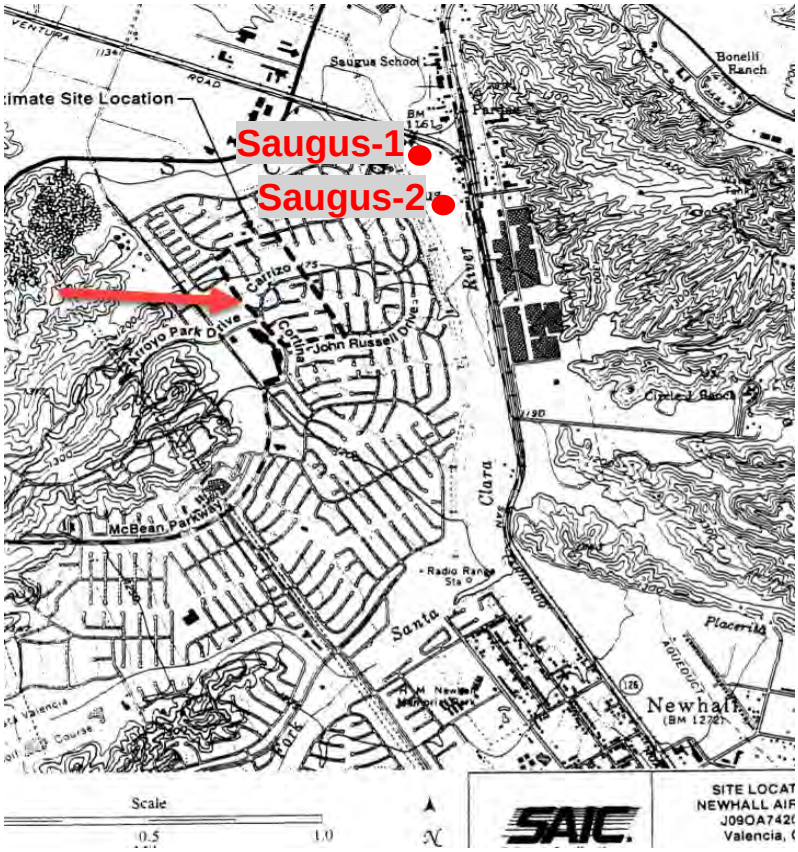

FIGURE K

4.6 Migration of perchlorate, PCE, and TCE in Groundwater

To understand the water quality data that has been collected at and downgradient of the Whittaker Site it is helpful to understand how chemicals (contaminants) dissolved in

groundwater migrate through both the unsaturated zone (between the surface and the water table) and the saturated zone (below the water table). The primary mechanism controlling the migration of chemicals is the movement of the groundwater itself, called advection. In other words, when a chemical is dissolved in groundwater it will move with and in the same direction the groundwater is moving. If you can determine where groundwater is moving, you know where the chemical is moving.

The second primary mechanism is called dispersion. Dispersion is a mixing process that results in the dilution of the contaminant in groundwater. The mixing results due to the groundwater moving through the subsurface material (e.g. sand, silt, sandstone). It does not flow in a straight path, rather the groundwater flows in an irregular path around the aquifer material, resulting in sinuous flow paths and the spreading and dilution of the contaminant. The result of dispersion is that the concentration of a contaminant dissolved in groundwater will decrease with distance from the original source, due to the dispersion or dilution.

Another important mechanism that impacts the movement of contaminants dissolved in groundwater is called retardation. Retardation is due to the chemical reacting with the aquifer material and being held up or retarded. As the dissolved chemical moves through the subsurface, in both the unsaturated zone and the saturated zone, some of the chemical will adsorb or stick to the aquifer material. The result is that the contaminant moves slower than the rate of the groundwater due to the sorption of the contaminant to the geologic materials. The amount of retardation is dependent on a chemical's physical properties and the characteristics of the aquifer it is migrating through. Some chemicals are more likely to sorb onto aquifer materials than others. For example, due to retardation, TCE and PCE can move at a rate up to 10 times slower than the rate of groundwater. They sorb easily. Perchlorate has been shown to exhibit little or no retardation and moves at approximately the same rate of groundwater since it does not sorb. The net result is that if two chemicals are released to groundwater at the same place and time, they may travel at different rates. If one chemical moves 10 times slower than another chemical, the faster chemical will travel 10 times as far as the slower moving chemical (ex. 1000 feet v. 100 feet).

This phenomenon has been extensively studied by the groundwater research community. One of the earliest field studies was conducted by Stanford and the University of Waterloo. In this field study, a non-reactive chemical (chloride) and several organic chemicals (including PCE) were injected into a sand aquifer at the same location and same time. The results of the field study showed that the PCE migrated at a rate of approximately 3 to 6 times slower than the rate of groundwater and was also 3 to 6 times slower than the migration rate of the non-reactive chloride. Figure L shows the migration of chloride and PCE in the aquifer after 647 and 633 days respectively (highlighted). The center of mass of the chloride impacted groundwater

has migrated approximately 5 times as far as the center of mass of the PCE impacted groundwater.

As discussed above, this same phenomenon is seen at the Bermite Site where the perchlorate has migrated much further in groundwater than PCE or TCE.

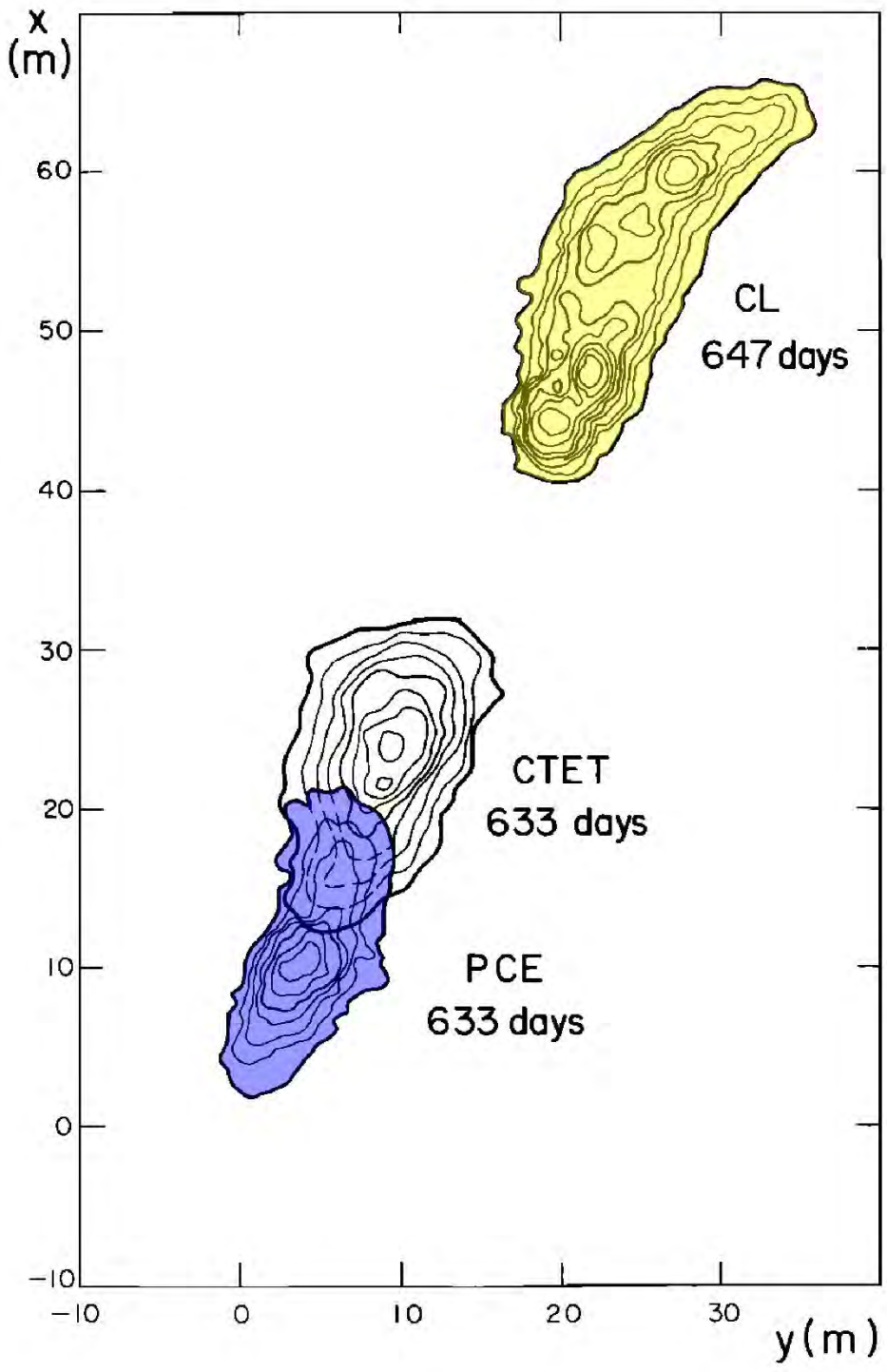
X
(m)
60
50
40
30
20
10
0
-10
-10
0
10
20
30
y (m)
CL
647 days
CTET
633 days
PCE
633 days

FIGURE L

5. OPINIONS

5.1 Opinion 1

The investigations at the Bermite Site determined that perchlorate and VOCs were generally released from the same source areas.

As discussed in Section 4.2.2.2, the remedial investigations conducted at the Bermite Site identified areas where soil was impacted by perchlorate and VOCs. These areas, called source areas, are the primary areas where perchlorate and VOCs migrated downward through the unsaturated zone and entered groundwater. Source areas were identified in all six OUs (OU-1 to OU-6) on the Bermite Site. The investigations concluded that the source areas were essentially the same for perchlorate and VOCs. This means that the areas where perchlorate and VOCs migrated through the unsaturated zone and entered the groundwater beneath the Bermite Site were essentially the same.

CH2MHill, the Water Agency's consultant, agreed in the VOC Report stating: "In addition, many of the VOC and perchlorate source areas on the former Whittaker Bermite Facility are collocated (Figure 5-1), suggesting similar sources and migration pathways could exist for perchlorate and TCE impacts in Saugus formation groundwater."

5.2 Opinion 2

Perchlorate and VOCs released from the source areas on the Bermite Site followed the same migration pathway in the unsaturated zone and in groundwater.

Perchlorate and VOCs were released at the Bermite Site from the same source areas. The perchlorate and VOC releases migrated downward through the unsaturated zone to the water table and entered the groundwater. Upon entering the groundwater, these dissolved chemicals begin slowly moving with and in the direction the groundwater was moving. It is well established that chemicals dissolved in groundwater will simply move along with and in the same direction as the groundwater. For the Bermite Site this means that the chemicals that were released and migrated downward to the water table followed the same pathway as they migrated downgradient with the groundwater. In other words, perchlorate, TCE, PCE and other chemicals released at the Bermite Site moved along the same pathway.

The perchlorate data collected from groundwater monitoring wells on and off the Bermite Site and from groundwater production wells show that perchlorate from source areas on the

Bermite Site has migrated in groundwater in a northwesterly direction. Figure 42 is Figure 5-4 from the CH2MHill VOC Report and shows the extent of the perchlorate plume from the Bermite Site (the orange area of Figure 42). VOCs from the Bermite Site followed the same pathway as the perchlorate.

The CH2MHill VOC Report hypothesized that the VOCs from the Bermite Site migrated along different pathways than the perchlorate (see Figure 5-5 in the CH2MHill VOC Report). Specifically, the CH2MHill VOC Report hypothesizes that VOCs did not migrate in a northwesterly direction through the western boundary of the Site, even though this is the pathway perchlorate migrated. As discussed above, chemicals dissolved in groundwater, released at the same location do not migrate along different pathways. The CH2MHill Report hypothesized VOC migration pathways are not supported by the water level or water quality data collected at the Bermite Site. The CH2MHill VOC Report calls these pathways "conceptual" and Mr. Lechler testified that the VOC pathways presented in the VOC Report were hypothetical and that more data would be needed to determine if they actually exist. Mr. Lechler testified that the additional information was needed because it couldn't be concluded that the Bermite Site was the source of VOCs in Saugus 1 and Saugus 2. He testified that the recommended data has not been collected.

It is my opinion that perchlorate and VOCs released from the source areas on the Bermite Site followed the same migration pathway in the unsaturated zone and in groundwater.

5.3 Opinion 3

Due to the different migration rates of perchlorate and VOCs in groundwater, releases of perchlorate from the source areas have migrated faster and further than VOCs.

As discussed in Section 4.6, there has been considerable research examining the migration of dissolved chemicals in groundwater. Perchlorate has been shown to migrate essentially at the same rate as groundwater. VOCs, such as PCE and TCE, on the other hand, have been found to migrate at a slower rate than the rate of groundwater. A number of representative research papers are included in Exhibit A that discuss the differences in migration rates of perchlorate, PCE and TCE. This research has found that TCE and PCE move 2 to 10 times slower than the rate of groundwater. The CH2MHill VOC Report agreed, stating: "The retardation factors for TCE and PCE in sand and gravel aquifers low in organic matter, similar to aquifer materials of the study area, are expected to fall between 1 and 10 (Mackay, et al., 1985)." For example, the Stanford/Waterloo study discussed in Section 4.6 found that PCE migrated approximately 5 times slower than groundwater in a uniform clean sand aquifer.

The CH2MHill VOC Report stated that the "overall distribution of TCE in the Saugus Formation is very similar to the distribution of perchlorate." Figure 42, Figure 5-4 from the CH2MHill VOC Report, shows the extent of the perchlorate plume and presumably shows the extent of the TCE plume from the Bermite Site. The extent of perchlorate in groundwater at and downgradient of the Bermite Site is well supported by perchlorate data in monitoring and groundwater production wells. However, the extent of the TCE plume shown in Figure 42 is not supported by the TCE data, specifically the dashed line downgradient of the Bermite Site. The use of the dashed line means that there is uncertainty with the line. As discussed in Sections 4.2.2.5 and 4.2.2.6, the VOC detections in monitoring and groundwater production wells are not from the Bermite Site.

As the CH2MHill VOC Report stated, "similar sources and migration pathways could exist for perchlorate and TCE impacts in Saugus formation groundwater." Contaminants released at the same location dissolved in groundwater would flow along with the groundwater and follow the same pathway as discussed in Opinion 2. They both simply travel along with and in the same direction as the groundwater. An examination of Figure 42 from the CH2MHill VOC Report shows that monitoring locations on the western boundary of OU-4, north of OU-4, and south of OU-4 are open circles, meaning that TCE was not detected at these locations. Dissolved plumes of TCE do not have gaps as seems to be indicated on Figure 42. The TCE data collected at the Bermite Site, discussed in detail in Sections 4.2.2.3, 4.2.2.4, and 4.2.2.5, shows that the PCE and TCE plume has not extended as far downgradient of OU-4 as shown on Figure 42. The TCE data shows that the solid blue line in Figure 42, east of the western boundary of OU-4, is the extent of the TCE plume.

The overall distance the perchlorate plume has migrated is approximately 2 to 2 ½ times the distance the TCE plume has migrated. This difference in migration distances is due to the retardation of TCE compared to perchlorate. The retardation of TCE at source areas first occurred in the unsaturated zone as the dissolved TCE moved downward to the water table and then as it migrated with the groundwater. The TCE released at the Bermite Site has migrated approximately 2 to 2 ½ times slower than perchlorate. As discussed above, this difference in migration rates is supported by the research done on the retardation of these chemicals in groundwater. The CH2MHill VOC Report stated that the retardation of PCE and TCE was up to 10 times more than perchlorate.

It is my opinion that based on the data collected at the Bermite Site, perchlorate and VOCs were released in the same areas and due to the differences in their migration rates in groundwater, perchlorate has migrated further than TCE and PCE.

5.4 Opinion 4

Although perchlorate has impacted Water Agency groundwater production wells downgradient of the Bermite Site, based on the differences in migration rates and supported by the water quality data, VOCs from the Bermite Site have not migrated to the Water Agency's groundwater production wells and the Bermite Site is not a source of the VOC detections in the wells at issue.

As discussed in Opinion 1, Section 4.2.2.2 describes the results of the remedial investigations at the Bermite Site that show the source areas for perchlorate and VOCs. The investigations concluded that the source areas for perchlorate and VOCs were essentially the same. Releases at these source areas migrated downward through the unsaturated zone to the water table and entered the groundwater. The perchlorate and VOCs dissolved in groundwater then moved with and in the direction the groundwater was moving and moved along the same pathway. The perchlorate plume, shown in Figure 42 (the orange area), has migrated in a northwesterly direction. VOCs from the Bermite Site followed the same pathway as the perchlorate.

As discussed in Section 4.8 and Opinion 3, the rate of migration of perchlorate in the unsaturated zone and in groundwater is different than the migration rate of PCE and TCE. Perchlorate has been shown to migrate at about the same rate as the rate of groundwater. PCE and TCE have been shown to migrate up to 10 times slower than the rate of groundwater. This widely studied and accepted phenomenon means that perchlorate released at the Bermite Site would have migrated faster and further than PCE and TCE.

These different migration rates are supported by the perchlorate, TCE, and PCE data collected at and downgradient of the Site. The most recent perchlorate groundwater data, discussed in Section 4.2.2.3, shows that perchlorate has reached the western boundary of OU-4 and has migrated off-site. The most recent VOC data shows that VOCs have not reached the western boundary of OU-4 and have not migrated off-site. Section 4.2.2.4 examines the maximum concentrations of perchlorate and VOCs detected at the western boundary of OU-4 since groundwater sampling began. The data confirms that perchlorate migrated to and downgradient of the western boundary of OU-4 and VOCs have not reached the boundary and have not migrated off-site.

The CW-01 well nest is located north of OU-4 and west of OU-5. The three wells in the CW-01 well nest are screened at different depths in HSU S-III and all of the wells have detected perchlorate at concentrations ranging from 1.6 to 11.2 µg/L. PCE and TCE have not been detected in these wells. Based on water level measurements, groundwater flow is to the east in this area, from the CW-01 well nest towards the RMW-04 well nest in OU-5.

VOCs are present in groundwater at the Northern Alluvium Area and have migrated off-site in the shallow Alluvium aquifer in a northwesterly direction. However, the data shows that the VOCs in the shallow groundwater did not migrate to the Water Agency Saugus Formation production wells and there is no evidence that the VOCs migrated downward into the Saugus Formation from the Northern Alluvium Area and impacted the production wells. As discussed in Section 4.2.2.1, the Northern Alluvium Area is located north of the San Gabriel Fault. The San Gabriel Fault has been shown to be a barrier to groundwater flow in the Saugus Formation. VOCs in the Saugus Formation in the Northern Alluvium Area would not migrate south of the San Gabriel Fault. The Water Agency Saugus Formation groundwater production wells are located south of the San Gabriel Fault.

TCA has been detected in the Alluvium aquifer in the Northern Alluvium Area on the Bermite Site. The highest historical concentration of TCA detected in the Northern Alluvium Area was 12,000 µg/L in monitoring well 75-MW-26A. TCA has been detected in Alluvium wells downgradient of the Northern Alluvium Area, however, TCA has not been detected in Alluvium wells in the proximity of Saugus 1 and Saugus 2. TCA has also not been detected in Saugus 1, Saugus 2, V-201 or V-205.

It is my opinion that PCE and TCE have not migrated from the Bermite Site to the Water Agency groundwater production wells. The Bermite Site is not the source of the detections of PCE and TCE in their groundwater production wells.

5.5 Opinion 5

VOCs from the Bermite Site have not impacted the Water Agency's groundwater production wells V-201 and V-205.

As discussed in Opinion 4, VOCs from the Bermite Site have not migrated to the Water Agency's groundwater production wells. The Water Agency groundwater production wells V-201 and V-205 are located west of Saugus 1 (Figure 4). Well V-210 is located approximately 3900 feet west of Saugus 1 (3/4 of a mile) and well V-205 is located approximately 6200 feet west of Saugus 1 (over a mile).

As discussed in Section 4.2.2.5, VOCs have been detected in monitoring wells in the vicinity of V-201 and V-205. The concentrations of VOCs are higher than concentrations detected in upgradient monitoring wells. Three of the wells are screened in the S-IIIc formation and one well is screened in the S-Va formation. Both V-201 and V-205 draw water from these formations. This data supports the presence of other potential unidentified sources in the vicinity of Water Agency groundwater production wells V-201 and V-205.

The capture zones developed by CH2MHill are shown in Figure 30. The capture zone for V-201 is in an area north and south of the well and does not include or encompass the Bermite Site. The capture zone for V-205 is also shown in Figure 30. The capture zone for V-205 shows that when pumping, groundwater comes from an area north and south of the well and does not include or encompass the Bermite Site. In 2019 Kennedy Jenks used a groundwater model to determine the capture zone for groundwater production well V-201. The capture zone is shown in Figure 31. The modeled capture zone shows that groundwater entering well V-201 when it is pumping comes from areas north and south of the well. The capture zone also shows that the four groundwater monitoring wells with TCE detections are within the area that is captured by V-201.

It is my opinion that VOCs from the Bermite Site have not impacted the Water Agency's groundwater production wells V-201 and V-205.

5.6 Opinion 6

VOCs have contaminated groundwater at the SIC Site and there is a plausible pathway for groundwater from the SIC Site to migrate to the Water Agency groundwater production wells due to the unique geology of the SIC Site and its proximity to the groundwater production wells.

The SCVWA Saugus 1 groundwater production well is located 900 feet west/southwest of the SIC Site (Figure 32). The Saugus 1 groundwater production well is 1640 feet deep and has eight screen intervals, all in the Saugus Formation. The well screens for Saugus 1 are located from 490-510, 570-630, 710-810, 890-1000, 1020-1080, 1130-1190, 1240-1320, and 1400-1620 feet below ground surface (Figure 43).

The SCVWA Saugus 2 groundwater production well is located approximately 1200 feet south of the SIC Site (Figure 32). This well is 1611 feet deep and has seven screen intervals, all in the Saugus Formation. The well screens for Saugus 2 are located from 510-550, 580-720, 820-880, 920-960, 1040-1100, 1210-1250, and 1310-1590 feet below ground surface (Figure 43).

Groundwater monitoring well SG1-HSU3c is located approximately 20 feet west of GS-13B and 500 feet east of Saugus 1. SG1-HSU3c is screened at a depth of 720 to 740 feet below ground surface. Groundwater monitoring well AL-12B is located approximately 500 feet southwest of GW-13B.

The capture zones for the Saugus 1 and Saugus 2 groundwater production wells were determined by using a computer model. A capture zone is the area of an aquifer from which groundwater is drawn into a groundwater production well when a well is pumping. The capture zone for the Saugus 1 groundwater production well extends to and includes the location of groundwater monitoring well SG1-HSU3c and the western portion of the SIC Site itself.

The Saugus Formation dips at a 60-degree angle to the southwest at the SIC Site, in the direction of the Saugus 1 and Saugus 2 groundwater production wells. Away from the fault zone where the SIC Site is located, the regional dip of the Saugus Formation is approximately 10 degrees. The transition of the 60-degree dip of the Saugus Formation at the SIC Site to the regional dip of 10 degrees has not been mapped. To estimate where the Saugus Formation that is present under the SIC Site intersects the Saugus 1 and Saugus 2 groundwater production wells a range of dipping angles between the SIC Site and the groundwater production wells is used. The average dipping angle would be 35 degrees (the average of 60 and 10 degrees). The average dipping angle will by bracketed by + 5 degrees to produce a range of 30 to 40 degrees.

Based on this range, groundwater (and contaminants in the groundwater) migrating in the dipping Saugus Formation would intersect the Saugus 1 groundwater production well, located 900 feet from the SIC Site, at an approximate depth of 520 to 755 feet below ground surface (bgs).

Groundwater (and contaminants) migrating in the dipping Saugus Formation would intersect the Saugus 2 groundwater production well, located 1200 feet from the SIC Site, at an approximate depth of 690 to 1000 feet bgs.

Based on these estimates, groundwater from the SIC Site would enter well screens in both the Saugus 1 and Saugus 2 groundwater production wells. Figure 44 is a conceptual cross section showing the approximate locations of the SIC Site, the Saugus 1 and Saugus 2 groundwater production wells, and the dipping Saugus Formation.

TCE has been detected in both Saugus 1 and Saugus 2 groundwater production wells. The highest concentrations of TCE detected in Saugus 1 and Saugus 2 groundwater production wells are 4.2 and 1.2 µg/L, respectively. In 2019 TCE concentrations in Saugus 1 groundwater production well ranged from 0.7 to 1.3 µg/L. TCE concentrations in Saugus 2 groundwater production well in 2019 ranged from <0.5 to 0.6 µg/L µg/L. Jose Diaz, the DTSC project manager of this Site, testified that DTSC considers the SIC Site a potential source of VOCs, including TCE, in the Saugus 1 and Saugus 2 groundwater production wells. Benjamin Lechler, a consultant to SCVWA, testified that there was a plausible pathway for VOCs to move from the

SIC Site to the portion of the Saugus Formation where groundwater enters the Saugus 1 and Saugus 2 groundwater production wells.

Chloroform has also been detected in Saugus 1 and Saugus 2 groundwater production wells. Chloroform was detected in 134 of the 141 sampling events and in Saugus 1 groundwater production well from 2010 to 2013. In Saugus 2 groundwater production well, chloroform was detected in nine of 114 sampling events during the same time period.

The highest concentrations of TCE and chloroform were detected on the SIC Site. TCE and chloroform have been detected in decreasing concentrations in a westerly direction toward the GW-13 wells, located between the SIC Site and Saugus 1 groundwater production well, in SG1-HSU3c, and in AL-12B located adjacent to Saugus 1 groundwater production well (Figure I).

Groundwater contaminated with VOCs, including TCE, is present on the SIC Site. VOCs, including TCE, are also present in Saugus 1 and Saugus 2 groundwater production wells located 900 and 1200 feet from the SIC Site. The same is true for chloroform. Groundwater at the SIC Site and the groundwater production wells are each contaminated with TCE and chloroform. Groundwater monitoring data shows that TCE and chloroform have migrated west across Railroad Avenue and are found in the 180-foot deep monitoring well GW-13B located adjacent to Saugus 1 groundwater production well.

The Saugus Formation has been mapped to be dipping 60 degrees to the southwest at the SIC Site in the direction of Saugus 1 and Saugus 2 groundwater production wells. TCE has been detected in a deeper well screened in the Saugus Formation located between the SIC Site and the groundwater production wells. Contaminated groundwater at the Site is present in groundwater monitoring wells at the SIC Site in the Saugus Formation. TCE has been detected in both Saugus 1 and Saugus 2 groundwater production wells. Contaminated groundwater migrating in the steeply dipping Saugus Formation would therefore intersect the screened intervals in Saugus 1 and Saugus 2 groundwater production wells at depth. Chloroform has consistently been detected in Saugus 1 groundwater production well and occasionally in Saugus 2 groundwater production well.

It is my opinion that a plausible pathway exists for contaminated groundwater from the SIC Site to migrate to Saugus 1 and Saugus 1 groundwater production wells.

5.7 Opinion 7

SIC has not met the criteria to be a Bona Fide Prospective Purchaser.

In December 2003, SIC purchased the property from Keysor through a bankruptcy court sale. SIC asserts that it qualifies as a Bona Fide Prospective Purchaser. The criteria to qualify as a Bona Fide Prospective Purchaser are contained in 42 U.S.C. 9601 (40) and are as follows:

(A) In general. The term "bona fide prospective purchaser" means, with respect to a facility:

(i) a person who

(I) acquires ownership of the facility after January 11, 2002; and

(II) establishes by a preponderance of the evidence each of the criteria described in clauses (i) through (viii) of subparagraph (B); and

(B) Criteria. The criteria described in this subparagraph are as follows:

(i) Disposal prior to acquisition.

All disposal of hazardous substances at the facility occurred before the person acquired the facility.

(ii) Inquiries.

(I) In general.

The person made all appropriate inquiries into the previous ownership and uses of the facility in accordance with generally accepted good commercial and customary standards and practices in accordance with subclauses (II) and (III).

(II) Standards and practices.

The standards and practices referred to in clauses (ii) and (iv) of paragraph (35)(B) shall be considered to satisfy the requirements of this clause.

(iii) Notices.

The person provides all legally required notices with respect to the discovery or release of any hazardous substances at the facility.

(iv) Care. The person exercises appropriate care with respect to hazardous substances found at the facility by taking reasonable steps to—

(I) stop any continuing release;

(II) prevent any threatened future release; and

(III) prevent or limit human, environmental, or natural resource exposure to any previously released hazardous substance.

(v) Cooperation, assistance, and access.

The person provides full cooperation, assistance, and access to persons that are authorized to conduct response actions or natural resource restoration at a vessel or facility (including the cooperation and access necessary for the installation, integrity, operation, and maintenance of any complete or partial response actions or natural resource restoration at the vessel or facility).

(vii) Requests; subpoenas.

The person complies with any request for information or administrative subpoena issued by the President under this chapter.

SIC failed to meet the following criteria:

a. 42 U.S.C. 9601 (40) (B) (i) – all disposal must occur before the property was acquired;

b. 42 U.S.C. 9601 (40) (B) (ii) (I) - all appropriate inquiries made in compliance with accepted good commercial practices;

c. 42 U.S.C. 9601 (40) (B) (iv) – exercised appropriate care to stop any continuing release; prevent any threatened future release; and prevent or limit human, environmental, or natural resource exposure to any previously released hazardous substances; and

d. 42 U.S.C. 9601 (40) (B) (vii) – the person complies with environmental agency directives and requests.

Disposal of hazardous substances occurred after SIC acquired ownership and control of the property: 42 U.S.C. 9601 (40) (B) (i)

CERCLA 42 U.S.C. 9601 (40) (B) (i) requires that "all disposal of hazardous substances at the facility occurred before the person acquired the facility."

USEPA conducted a CERCLA Screening Site Inspection of the SIC Site in 1989. The purpose of a Screening Site Inspection is to determine if a site should be addressed under the federal Superfund program. The report for the Screening Site Inspection stated that "large quantities of hazardous substances were discharged on site".

Ninyo & Moore conducted a Phase I Environmental Site Assessment in 2000. The Phase I report concluded that there were recognized environmental conditions on the Site.

The California Regional Water Quality Control Board (Water Board) conducted an inspection of the Site on April 25, 2002.11 The Site Inspection report concluded that "Regional Board staff is concerned about the numerous releases that had formerly occurred at this facility."

Based on the 1989 USEPA Screening Site Inspection, the 2000 Phase I and the 2002 Water Board site inspection hazardous substances were present on the property before SIC acquired ownership and control of the property.

In December 2003, SIC purchased the property from Keysor through a bankruptcy court sale. SIC knew the property was contaminated. Prior to the purchase, SIC's consultant RAMCO prepared a Preliminary Environmental Assessment (PEA) report for the SIC Site. The PEA report was issued in October 2003. The site visit for the PEA took place on September 24, 2003. The PEA report stated that at the time of the site visit "all tanks, reaction vessels, drums, and bins were found to be empty." Subsequent work at the Site confirmed that this information was false.

In 2004, after SIC assumed ownership and control of the property, demolition and removal of multiple chemicals, tanks, sumps, and other equipment left on the property by Keysor took place. Hazardous waste manifests show that liquid waste from tanks and drums was removed from the Site after the September 24, 2003 PEA site visit and after SIC acquired ownership and control of the property. In addition, hazardous waste manifests show that rinsate from tanks were removed from the Site as hazardous waste. Based on the hazardous waste manifests, the statement in the PEA report prepared by SIC's consultant indicating that the chemical tanks were empty was false. For example, a December 10, 2003 hazardous waste manifest lists 2000 gallons of hazardous waste liquid containing TCE and lead.

RAMCO removed nine sumps in April and May 2004. The sumps were connected to underground pipes that brought wastewater in and then other pipes that transmitted the collected wastewater to a treatment area. The sumps were found to contain a total of approximately 4000 gallons of water. The water was sampled and analyzed and found to contain several VOCs, including TCE. The water was removed prior to demolition. The underground pipes that brought wastewater into the sumps were washed and then plugged in

place at the exterior wall of the sump. The underground pipes that transmitted the wastewater to the treatment area were cut and both ends were plugged.

In my 40 years of working on industrial properties it is my experience that it would be extremely difficult to remove numerous sumps, underground pipes, chemicals from tanks and drums that were used to store various chemicals used in the chemical manufacturing process and rinse large tanks that contained the chemicals used at the facility without releasing some of the chemicals to the ground surface. I have found no documentation of the procedures used during the demolition process, including how the decommissioning of the drums and large chemical storage tanks was conducted and the procedures used to ensure that no wastewater containing VOCs were released during the cutting of the wastewater pipes and excavation of the sumps. It is likely that disposal of hazardous substances occurred during the demolition and equipment removal process.

SCI has not met the all appropriate inquiry requirements: 42 U.S.C. 9601 (40) (B) (ii) (I)

CERCLA 42 U.S.C. 9601 (40) (B) (ii) (I) is a requirement that all appropriate inquiries are made into the previous ownership and uses of the facility in accordance with generally accepted good commercial and customary standards and practices. All appropriate inquiry is defined as performing a Phase I environmental site assessment consistent with standards established by the American Society of Testing and Materials (ASTM). The purpose of performing the Phase I prior to acquisition of a property is to evaluate the environmental conditions and to assess potential liability for any contaminants.

The ASTM standard for Phase I environmental site assessments at the time of the 2003 PEA was ASTM E 1527-00.

The 2003 PEA performed by RAMCO failed to follow the ASTM E 1527-00 Standard, as demonstrated below.

One part of the Phase I assessment is a site reconnaissance or site visit. The ASTM E 1527-00 Standard states that the objective of the site reconnaissance is to "obtain information indicating the likelihood of identifying recognized environmental conditions in connection with the property." The term recognized environmental condition is defined as "the presence or likely presence of any hazardous substances of petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, ground water, or surface water of the property."

RAMCO failed to conduct a site reconnaissance according to the ASTM Standard.

The ASTM Standard specifies that the site reconnaissance include, in part (a) observation of the interior of structures, (b) the approximate quantities, present and past, of hazardous substances and petroleum products used at the property, types of containers and storage conditions, (c) identification of above ground storage tanks, underground storage tanks, vent pipes, fill pipes (content, capacity, age), (d) identification of odors, (e) sumps containing liquids likely to be hazardous substances shall be described, (f) description of drums and contents, (g) identification and description of containers identified as containing hazardous substances, including quantities, types of containers and storage conditions, (h) means of heating and cooling buildings including fuel sources, (i) identification and description of stains or corrosion on floors, walls or ceilings, (j) identification and description of floor drains, (k) identification and description of pits, ponds, or lagoons, (l) identification of stained soil or pavement, and (m) identification of stressed vegetation. Based on Section 5.0 of the RAMCO Phase I, Information From Site Reconnaissance/Interviews, not a single one of these 13 requirements were met by RAMCO.

The PEA report stated that at the time of the site visit "all tanks, reaction vessels, drums, and bins were found to be empty." As discussed above, based on hazardous waste manifests after the PEA site visit and after SIC acquired the property, this statement is false.

Section 10 of the ASTM Standard also requires that a reasonable attempt shall be made to interview at least one staff member of a local government agency, including the local fire department, local health agency, or local or regional office of a state environmental agency. According to the RAMCO Phase I report, no local government agency officials were interviewed.

The ASTM E 1527-00 Standard states: "The purpose of this practice, as well as Practice E 1528, is to define good commercial and customary practice in the United States of America for conducting an environmental site assessment of a parcel of commercial real estate with respect to the range of contaminants within the scope of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and petroleum products."

The ASTM E 1527-00 Standard further states: "In defining a standard of good commercial and customary practice for conducting an environmental site assessment of a parcel of property, the goal of the processes established by this practice is to identify recognized environmental conditions."

The 2003 RAMCO PEA did not identify any recognized environmental conditions or their impact on the property. It only provided a general recommendation "for further investigation of the site soil and groundwater". As stated in Section 11.7 of the ASTM E 1527-00 Standard: "The report shall include a conclusions section that summarizes all recognized environmental

conditions connected with the property and the impact of these recognized environmental conditions on the property." A Phase I Environmental Site Assessment was conducted at the property in 2000 by Ninyo & Moore. As required by the ASTM Phase I standard, Ninyo & Moore identified 15 recognized environmental conditions. For example, Ninyo & Moore identified one of the recognized environmental conditions as follows: "The reactor sump concrete is corroded, creating a cavity and exposing the soils behind the sump."

The identification of recognized environmental conditions and their impact on a property is the stated purpose of the ASTM Phase I standard.

The RAMCO PEA did not list any recognized environmental conditions connected with the property and their impact on the property as required. Without the identification of specific recognized environmental conditions prior to acquiring the property, it would be impossible to determine if specific releases identified in the future were present prior to the acquisition.

The RAMCO PEA did not meet the requirements of ASTM E 1527-00 Standard and did not meet the requirement of 42 U.S.C. 9601 (40) (B) (ii) (I).

SIC failed to take the steps necessary to meet the requirements of 42 U.S.C. 9601 (40) (B) (iv)

CERCLA 42 U.S.C. 9601 (40) (B) (iv) (I) requires that reasonable steps be taken to stop any continuing releases of hazardous substances. The definition of "release" contained in 42 U.S.C. 9601 (22) includes any leaching of hazardous substances. As discussed above, SIC had ample knowledge that disposal of hazardous substances had previously occurred at the Site. The previous disposal of hazardous substances would have contaminated the soil and residual water below the ground surface. These hazardous substances would have continued to migrate downward due to leaching by rainwater that infiltrated into the ground. Photographs taken in February 2005 show conditions at the Site during a rainfall event that would lead to infiltration of water into the ground (Exhibit G). The continued migration of contaminants would reach the groundwater after a period of time. SIC delayed addressing the continued leaching of these hazardous substances for 12 years, allowing them to migrate freely on and off the Site.

CERCLA 42 U.S.C. 9601 (40) (B) (iv) (II) requires that reasonable steps be taken to prevent any threatened future release of hazardous substances. As discussed in the preceding paragraph, releases of hazardous substances that had contaminated the soil and residual water below the ground surface not only threatened to contaminate the underlying groundwater, but these releases would and did contaminate the groundwater due to infiltrating rainwater. SIC did not take steps to prevent threatened future releases until 2016, 12 years after taking ownership and control of the Site from Keysor.

CERCLA 42 U.S.C. 9601 (40) (B) (iv) (III) requires that appropriate care be exercised with respect to hazardous substances found at the facility by taking reasonable steps to prevent or limit human, environmental, or natural resource exposure to any previously released hazardous substance. It was not until 2016 that SIC took steps to prevent or limit the exposure.

An in-situ groundwater remediation program was initiated at the SIC Site in January 2017, approximately 13 years after SIC took ownership and control of the property. An Emulsified Vegetable Oil (EVO) substrate and microbial suspension was injected into several on-site wells to promote biodegradation of the VOCs. This remediation program only addressed contaminated groundwater on the SIC Site, leaving the off-site contaminated groundwater, which originated on the SIC Site, to freely migrate towards the SCVWA Saugus 1 and Saugus 2 groundwater production wells.

Only two of the groundwater monitoring wells installed by SIC were placed off the SIC property (GW-13A and GW-13B). Groundwater samples from these wells showed that contaminants from the SIC Site had migrated off site in the direction of SCVWA's groundwater production wells. The horizontal and vertical extent of the off-site impact to groundwater from the SIC has not been determined. Contaminated groundwater from the SIC Site that has migrated off site continues to migrate in tandem with the ongoing migration of groundwater. As the contaminated groundwater continues to migrate, the extent of the area of contaminated groundwater continues to increase.

On-site groundwater remediation will not reduce or control off-site groundwater contaminated by previous releases of hazardous substances from the SIC Site.

Since SIC has not characterized the off-site groundwater contamination that originated from its Site, SIC cannot establish the extent of human, environmental, and natural resource exposure making it impossible for SIC to determine the extent and scope of the existing and ongoing impacts of the contamination that has migrated off-site during the 16 years since it purchased the property.

Since SIC has not taken steps to remediate off-site groundwater contamination, they have failed to take appropriate care to prevent or limit human, environmental, or natural resource exposure to any previously released hazardous substances at and from the SIC Site and the requirements specified in 42 U.S.C. 9601 (40) (B) (iii) (III) have not been met.

SIC did not comply with DTSCs request under the VCA as required by 42 U.S.C. 9601 (40) (B) (vii)

CERCLA 42 U.S.C. 9601 (40) (B) (vii) requires compliance with any request for information or administrative subpoena. For the SIC Site, meeting this requirement means complying with DTSC requests and directives, including the VCA.

SIC signed a VCA with the DTSC in October 2007. DTSC agreed to oversee the characterization and cleanup of the Site proposed by SIC and SIC agreed to comply with the terms and conditions of the VCA, including the VCA schedule.

On September 22, 2011 DTSC sent out a Notice to Terminate the VCA to Hunt Braley, counsel to SIC, and Alex Palmer, consultant to SIC. The letter stated that "DTSC is terminating the agreement due to the lack of satisfactory investigation progress, poor project proponent responsiveness, and environmental concerns with known impacts (vinyl chloride) to soil and groundwater. SIC has failed to properly characterize the full nature and extent of contamination resulting from past operations on the Site and failed to respond to repeated requests by DTSC staff to negotiate the terms of an access agreement to complete the groundwater investigation along the southwestern perimeter of the contaminant plume. In addition, engineering and geological work performed at the Site and associated deliverables are not in conformance with applicable state law including but not limited to Business and Professions Code Sections 6735 and 7835."

SIC did not meet the requirement of 42 U.S.C. 9601 (40) (B) (vii).

Saugus Industrial Center failed to meet several of the statutory requirements necessary to establish itself as a Bona Fide Prospective Purchaser (BFPP), as such has not met the criteria to qualify as a BFPP as set out in 42 U.S.C. 9601 (40).

5.8 Opinion 8

There are other potential sources that could be contributing VOCs to the Water Agency's groundwater production wells.

As discussed in Section 4.5, the CH2MHill VOC Report did not consider or eliminated sites that potentially contributed TCE and PCE to groundwater. For example, a dry cleaner operated near Saugus 2 in the 1960's. The CH2MHill VOC Report did not identify this Site nor has any investigation of this Site been conducted. Dry cleaners in the 1960's used PCE and dry cleaners from this era have been found to impact soil and groundwater from the improper handling and disposal of PCE.

In the CH2MHill VOC Report, Sites were eliminated as potential sources even though inadequate information existed to make this determination. The Thatcher Glass Manufacturing Company, the Saugus/Newhall Airport, Dry Cleaners at Granary Square and other dry cleaners were all located within the capture zone of the Water Agency's groundwater production wells. Either no data or inadequate data exists to determine if these Sites contributed TCE and PCE to groundwater.

In addition, the TCE and PCE groundwater data suggests that there are other potential sources in the vicinity of the Water Agency's groundwater production wells. TCE and PCE data downgradient of Saugus 1 and Saugus 2 suggest that there are unidentified sources in this area. As discussed in Section 4.5, TCE data from monitoring wells DW-1B, Mall A, and Library Well B suggest a source of TCE in the vicinity of these wells.

It is my opinion that there are other previously unidentified Sites that are contributing TCE and PCE to the Water Agency's groundwater production wells.

5.9 Opinion 9

Based on the available data, other previously unidentified sources could be contributing VOCs in the Water Agency's distribution system.

Section 4.1.3 discusses TCE and PCE data collected from the Water Agency's distribution system. The water from the Perchlorate Treatment Plant is blended with water from Castaic Lake. TCE and PCE data collected from turnouts in the distribution system shows periodic detections.

The Water Agency uses chloride concentrations measured in the effluent from the Perchlorate Treatment Plant and the Castaic Lake water and the chloride concentrations in the water at the turnouts to estimate the dilution of the water from the Perchlorate Treatment Plant. An examination of the estimated dilution ratios at the turnouts shows large variations in a single sampling event. This variability of dilution ratios suggests that the predicted ratios are not reliable. I have seen no evidence that the chloride ratio method of predicting the dilution at the turnouts has been validated by the Water Agency.

The estimated dilution ratio is used to predict the TCE and PCE concentrations at the turnouts. These predicted TCE and PCE concentrations are compared to the measured values at the turnouts. There are times in which the predicted dilution ratios do not correlate with the VOC concentrations at the turnouts. An examination of the predicted TCE and PCE to the measured values shows variable results. The chloride derived ratios sometimes predict a detection and

no VOC is detected and other times the predicted VOC concentration is close to the measured value and other times its significantly different.

As discussed in Section 4.1.3, PCE concentrations in some of the samples are higher than those found in the effluent from the Perchlorate Treatment Plant. Between 2011 and 2015, PCE was detected at turnouts over the concentration from the plant effluent 23 times. For example, in May 2012 the PCE concentrations at turnout SC-1 were 5.7, 7.9, and 9.9 µg/L on three consecutive readings. And PCE was detected at a concentration of 17.0 µg/L at turnout SC-1 on July 16, 2012.

The Castaic Lake Water Agency (CLWA) published a report on March 21, 2013 describing an investigation into these PCE detections at turnout SC-1. The report stated that "CLWA is confident that Saugus 1 and 2 wells are not the source of the recent episodes of high PCE detection." CLWA stated that the PCE detections may have been associated with the former Flamingo Cleaners site which was located about 200 yards southeast of turnout SC-1. In 2014 and 2015, after modifications to the piping system, PCE was detected at turnout SC-1 at concentrations higher than the plant effluent 14 times.

Mr. Leserman, Senior Engineer with the Santa Clarita Valley Water Agency, testified that the PCE detections at SC-1 had nothing to do with the Whittaker Site. The Water Agency didn't determine if the detections were from a nearby dry cleaner, Flamingo Cleaners, or from some other source. The turnout data suggests that there are sources of PCE in the water supply other than Saugus 1 and Saugus 2. The Water Agency has concluded on several occasions that the Perchlorate Treatment Plant was not the source of the VOC detections at the turnouts and the source could not be determined. The turnout data suggests that there are unidentified sources of PCE in the water supply, other than Saugus 1 and Saugus 2.

It is my opinion based on the available data that other previously unidentified sources could be contributing VOCs in the Water Agency's distribution system.

6. SIGNATURE

The opinions in this report are based on my education, training, years of experience in environmental consulting, and the materials listed in Exhibit A. I may revise these opinions as additional documents, testimony, or discovery responses become available.

3 August 2020

Gary Hokkanen, MS

Date

Vice President

EXHIBIT A

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EXHIBIT B

Gary Hokkanen, Principal Hydrogeologist

Mr. Hokkanen has more than 40 years of experience in the investigation and remediation of contaminated property, with a focus on soil and groundwater contamination. His combined educational background in Engineering and Hydrogeology has been applied to all phases of environmental investigation and remediation. Mr. Hokkanen also is recognized as a top technical expert, with a reputation for providing attorneys with technical expertise in both the Remedial Investigation/Feasibility Study (RI/FS) process and litigation matters. He has been retained as an expert in litigation matters over the past 15 years. His RI/FS support has involved characterization of groundwater flow systems; analysis of contaminant fate and transport; development of feasibility studies; selection and design of soil, groundwater, and sediment remedial actions; agency negotiations; and technical observation of work performed by potentially responsible parties (PRPs).

Mr. Hokkanen has worked on and developed expert opinions relating to a wide variety of sites, including wood-treatment plants, dry cleaner facilities, landfills, manufacturing facilities, fuel-transfer facilities, oilfields, and disposal sites. Contaminants present at these sites have included chlorinated solvents, hydrocarbons, polycyclic aromatic hydrocarbons, PFCs (PFOA, PFOS), TCP, MTBE, pentachlorophenol, volatile organic compounds (VOCs), methyl tertiary- butyl ether, pesticides, and metals. The expert opinions provided by Mr. Hokkanen have involved cost allocation, remediation evaluation, standard of care, fate and transport of contaminants in groundwater, National Contingency Plan (NCP) compliance, and contaminant source identification.

Relevant Experience

PRIOR TESTIMONY

Mr. Hokkanen has testified at trial or by deposition as an expert in the following cases:

- *Carney Products v. B.J. Carney and Company*, Eastern District of Washington, Case No. CS 00-377-FVS (2004) (deposition)
- *Pacific Sound Resources, et al. v. BNSF, et al.*, Western District of Washington, Case No. C04-1654L (2006) (deposition)
- *Flint Hills Resources v. Shell Oil Company*, Arbitration (2007) (deposition and arbitration hearing testimony)

Education

- M.S. Hydrogeology, University of Waterloo, Waterloo, Ontario, Canada
- B.S. Civil Engineering, University of Minnesota, Minneapolis, Minnesota

Affiliations

- California Groundwater Association
- National Groundwater Association

Professional Profile

- Time with EKI: 1 month
- Total Years of Experience: 39

Professional History

- EKI, Principal Hydrogeologist. 2019
- Farallon Consulting, Principal Hydrogeologist. 2014-2019
- Hokkanen Environmental, Owner. 2004-2014
- Geomatrix Consultants, Principal Hydrogeologist. 1994-2004
- Geraghty & Miller, Principal Hydrogeologist. 1989-1994
- Barr Engineering, Senior Hydrogeologist. 1985-1989
- EWA, Staff Hydrogeologist. 1984-1985
- USEPA Region 9, Staff Engineer. 1980-1982

- *Maionchi, et al. v. Union Pacific Corporation, et al.,* Northern District of California, Case No. C 03 0647 JF (2007) (deposition)

- *Pacific Sound Resources, et al. v. BNSF, et al.*, Superior Court of Washington, Case No. 02-2-27778-1 SEA (2007) (deposition)

- *NJDEP, et al. v. Higgins Disposal, Inc. et al.,* Superior Court of New Jersey, Docket No. SOM-L-1885-04 (2008) (deposition)

- *Makallon Atlanta Huntington Beach, LLC v. Chevron Land and Development Company, et al.,* Superior Court of the State of California, Case No. 06CC06961 (2009) (deposition)
- *Amethyst Partners USA, LLC; Richard Stromberg vs. Marcus & Millichap; Brent Hogan; Matthew Sullivan; Emerson Apartments, LLC; Daniel Tripathi; Ian Knox; Michael Pesci; Joe B. Cooper IV; Clint Lukens, et al.*, Superior Court of the State of California For the County of Los Angeles Central District, Case No. BC397241 (2009) (deposition)

- *NJDEP, et al. v. Essex Chemical Corporation,* Superior Court of New Jersey, Docket No.: MID-L-5685-07 (2010) (deposition and court testimony)

- *NJDEP, et al. v. Union Carbide Corporation,* Superior Court of New Jersey, Docket No.: MID-L-5632-07 (2010) (deposition and court testimony)

- *NJDEP, et al. v. General Electric Corporation,* Superior Court of New Jersey, Docket No.: CAM-L-3338-07 (2010) (deposition)

- *Wells Fargo Bank, N.A., as Trustee for the Clara Poppic Trust, v. Kenneth G. Renz; Estate of Jackson R. Dennison; Estate of Wiley Umstead; Kazuko Umstead; Won Jae Yi aka Michael Yi; Nan Y. Park; Guan Huang; Ying Zhang and Sui Song; Hoyt Corporation, a Massachusetts Corporation*, United States District Court, Northern District of California, Case No.: CV 08-02561 SBA (2011) (deposition)

- *City of Modesto, et al., vs. The Dow Chemical Company, et al*., Superior Court of California, County of San Francisco, No. 999345 (2011) (court testimony)

- *Doris Alexander, et al., v. Exxon, et al.*, Los Angeles Superior Court, Case No. BC435640 (2012) (deposition)

- *Ron Block, et al., vs. Daniel Helix, et al*., Superior Court of the State of California, County of Contra Costa, Case No. MSC05-01725 (2012) (deposition)

- *Orange County Water District v. Sabic Innovative Plastics US, LLC, et al.,* Superior Court of the State of California In and For the County of Orange, Case No. 30-2008-00078246- CU-TT-CXS (2013) (deposition)

- *Bakercorp vs. J and S Development Corporation, et al.,* Superior Court of California, County of Contra Costa, Case No. MSC-10-02755 (2015) (deposition)

- *Heim v. The Estate of Donald T, Heim, Maxine Heim, et al.,* U.S. District Court, California Northern District, Case No. CV-10-03816 (2015) (deposition)

- *City of Los Angeles, et al., vs. County of Kern; Kern County Board of Supervisors.* Superior Court of the State of California in and for the County of Tulare, Case No. VCU 242057 (2015, 2016) (deposition and court testimony)

- *AmeriPride Services Inc., a Delaware corporation, vs. Valley Industrial Services, Inc., a former California corporation, et al*., United States District Court, Eastern District of California, Case No. CIV. S 00-113 MCE/EFB (2016) (deposition and court testimony)
- *Estate of Betty Goldberg and Estate of Al Goldberg, vs. Goss-Jewett Company, In., et al.,* United States District Court, Central District of California, Case No. 5:14-CV-01872-DSF (SHx) (2016) (deposition)
- *Von Duprin, LLC (Von Duprin) v. Moran Electric Services, Inc., Major Holdings, LLC, Major Tool and Machine, Inc., and Zimmer Paper Products Incorporated*, United States District Court, Southern District of Indiana, Case No. 1:16-CV-1942 (2018, 2019) (deposition and trial)

LITIGATION SUPPORT

Expert Opinion

- Expert Opinion Development, Orange County Water District South Basin, Irvine, California. Developed expert opinions and deposition testimony regarding the potential contribution from a manufacturing facility to groundwater and implications to deeper groundwater impacts. This facility overlies a chlorinated solvent plume from upgradient sources. Opinions related to the relative contribution to the comingled plume and the potential to impact underlying aquifers.

- Expert Opinion Development and Court Testimony, Chlorinated Solvent Plume, Sacramento, California. Developed expert opinions and provided court testimony regarding the contribution of two properties to

a chlorinated solvent plume. The opinions included an analysis of soil, soil gas and groundwater data from the two properties. A cost allocation was developed.

- Expert Opinion Development, Dry Cleaner Facility, Modesto, California. Developed expert opinions regarding the potential impact of a PCE plume from a dry cleaner on a City of Modesto water supply well. Examined the groundwater flow system, the fate and transport of the PCE plume and the capture zone of the water supply well. Provided testimony in an evidentiary hearing in San Francisco.

- Cost Allocation, Chlorinated Solvent Site, San Jose, California. Retained by attorneys to review the soil and groundwater cleanup conducted at a chlorinated solvent release site. The purchaser of the property had performed an RI and a soil and groundwater cleanup. Developed opinions regarding the cost-effectiveness and adequacy of the cleanup and consistency with State of California Guidance.
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- Source Identification and Cost-Recovery Support, Emeryville, California. Retained by one of several owners of a parcel undergoing remediation and redevelopment. Contaminants at the property include chlorinated VOCs, VOCs, and metals. Existing data collected at the Site were used to develop expert opinions regarding sources of contamination and to develop an allocation approach.
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- Expert Opinion Development, Manufacturing Facility, Irvine, California. Retained by one of the defendants in a large chlorinated solvent groundwater matter. Client was one of many PRPs sue by the local water district. Developed opinions regarding the adequacy of proposed groundwater cleanup alternatives, the sources and timing of chlorinated solvent releases, and the adequacy of the characterization of the groundwater flow and contaminant transport concepts developed by an opposing expert for allocation. Presented and defended expert opinions in deposition. Assisted in allocation mediation negotiations. The client was dismissed from the case.

- Expert Opinion Development, Dry Cleaner Facility, Watsonville, California. Developed expert opinions regarding the sources of PCE and daughter products in soil, soil gas, and groundwater at this dry cleaner facility. Examined historical PCE handling and disposal practices at the facility, the integrity of drains and sewer lines and the relative contribution of the facility and the City of Watsonville sewer system.

- Expert Opinion Development, Dry Cleaner Facility, Santa Barbara, California. Developed expert opinions regarding the sources of PCE and daughter products in soil and groundwater at this dry cleaner supply facility. Opinions involved an examination of historical storage of PCE, PCE delivery practices, and an upgradient dry cleaner.

- Expert Opinion Development, Dry Cleaning Facility, Berkeley, California. Retained by attorneys to develop expert opinions regarding the source of tetrachloroethene (PCE) in soil and groundwater at this active dry-cleaning facility. Expert opinions involved the source of PCE releases, the mechanism of these releases to the subsurface, the potential contribution of other parties to the PCE releases, the fate and transport of PCE in the subsurface and compliance with the NCP of the previous work at the Site.

- Expert Opinion Development, Dry Cleaner Facility, Buena Park, California. Developed expert opinions regarding the presence of PCE and degradation compounds in soil and groundwater at this dry cleaner facility, and the source of these contaminants in the subsurface, for use in cost allocation proceedings.

- Expert Opinion Development, Dry Cleaner Facility, Fairfield, California. Retained to develop expert opinions regarding the source of PCE and degradation compounds in soil, soil gas, and groundwater

at this dry cleaner facility. Presented opinions regarding the dry cleaner's contribution to the area wide PCE plume to a large PRP group in mediation. Presented opinions to the California Water Quality Control Board regarding dry cleaner's contribution to the area wide PCE plume, which resulted in a no contribution decision from the Water Board.

- Expert Opinion Development and Court Testimony, Biosolids Application, Bakersfield, California. Developed expert opinions and provided court testimony regarding the potential for the application of biosolids at a 4500-acre farm to impact groundwater. Expert opinions were initially provided in a declaration. A program to collect soil and groundwater data was developed and implemented. The field program examined the migration of metals and PFC compounds (PFOA and PFOS) through the soil column to the water table. Additional opinions were developed based on the information and provided in deposition and court testimony.

- Technical and Litigation Support, Former Wood-Treatment Facility, Madera, California. Retained by the attorneys for one of the property owners of this former wood-treatment facility that used pentachlorophenol to pressure-treat utility poles. Provided technical review of the RI/FS process conducted by another property owner on a portion of the property. Also provided observation for the investigation, FS, remedial design, and construction processes for remediation of impacted soil on another portion of the property.

  The remediation consisted primarily of excavating impacted soil. Prior to initiation of excavation, gained approval from the State agency to use a pentachlorophenol field-testing tool and statistical methods to determine impacted soil areas. Excavated soil was placed into an on-site containment vault used by both property owners. Coordinated the design and construction of the containment vault with the cleanup of adjoining parcels and arranged with the other PRP to place excavated soil in the containment vault.

  Also performed a complete technical review of soil and groundwater investigations, risk assessments, FSs, and remediation alternatives, including allocation issues, to develop expert opinions in support of litigation. Participated in mediation sessions, made presentations to the insurance carriers, and provided a videotaped presentation of expert opinions that was used in the negotiations.

- Litigation Support and Declaration, Solid Waste Landfill, Turlock, California. Retained to provide litigation support and develop expert opinions regarding the previous investigation and remediation at this closed unlined solid waste landfill. Examined historical landfill development, historical waste management practices, the adequacy of the remedial investigation and groundwater remediation system. Contaminants included chlorinated VOCs, VOCs, and metals. Provided declaration for the settlement process.

- Expert Opinion Development, Former Oil Field, Huntington Beach, California. Retained to develop expert opinions related to soil remediation at this former oil field. An RI and remediation were performed in an area of elevated lead and hydrocarbon concentrations in soil. Rendered opinions regarding whether the standard of care had been met in the performance of the work.

- Expert Opinion Development, Manufacturing Facilities, Indianapolis, Indiana. Retained to develop opinions related to consistency with the NCP for a comingled chlorinated solvent plume created by several adjacent manufacturing facilities. A downgradient facility was seeking cost recovery from the upgradient facilities. The remedial investigation and remediation were being performed under an Indiana Department of Environmental Management voluntary cleanup program. Testified in deposition that some requirements in the NCP were not met in the previous work at the Site under the State voluntary cleanup program.

- Expert Opinion Development, Fuel Transfer Facility, Ferrysburg, Michigan. Retained to provide expert opinions regarding the liability of various owners and operators of an active fuel transfer facility. The matter involved the degree of responsibility of past owners and operators for contamination of soil and groundwater by released fuels. Developed an Expert Report and was deposed in this matter. Provided testimony regarding the expert opinions formulated in this case.

- Expert Opinion Development, Solid Waste Landfill, St. Cloud, Minnesota. Retained to develop expert opinions regarding the source and extent of groundwater contamination related to a solid waste landfill. Examined the evolution of the landfill, waste records, and groundwater data. Contaminants included chlorinated VOCs, VOCs, and metals.

- Technical Review and Litigation Support, Wood-Treatment Facility, Illinois. Retained by the attorneys of the Principal Responsible Party to provide technical review and support for litigation with the current landowner for this NPL site. Technical issues involved the origin of creosote-related organic compounds, and the fate and transport of polycyclic aromatic hydrocarbon (PAH) and inorganic compounds in groundwater. Performed an extensive review and analysis of wood-treating operations, and of the origin, uses, and characteristics of the creosote. Collaborated with attorneys to prepare for trial and developed a technical strategy and questions for depositions of opposing experts.

- Rebuttal Expert Report Development, Drum Site, Somerset County, New Jersey. Retained by the New Jersey Attorney General's Office to prepare a Rebuttal Expert Report for an NCP compliance case involving chlorinated solvents in fractured bedrock. The site was a National Priority List (NPL) site where the RI/FS process had led to construction of a large groundwater pump and treat system. Approximately $25 million has been spent on investigation and remediation at the site since the work began in the mid-1980s. Development of the Rebuttal Expert Report included review of over 400 technical documents and numerous depositions, extensive analysis of two Expert Reports, research of specific technical and U.S. Environmental Protection Agency (EPA) policy issues, and development of the technical arguments that composed the Rebuttal Expert Report.

- Expert Report Development, Former Chemical Plant, Middlesex, New Jersey. Retained to develop expert opinions regarding the source and extent of chlorinated solvent groundwater contamination in fractured bedrock related to a former chemical and manufacturing plant that operated for over 80 years. Developed opinions related to the numerous sources of groundwater contamination and the timing of releases from those sources and developed estimates of the volume of contaminated groundwater over time. The case included both deposition and court testimony.

- Expert Opinion Development, Manufacturing Facility, Gardena, California. Retained by attorneys of previous owner of this manufacturing facility to develop expert opinions regarding the costs incurred by the current owner in the investigation and remediation of chlorinated solvent contamination and their consistency with the NCP. Determined that some of the investigation and remediation costs were not necessary response costs and were not consistent with the NCP.

- Contamination Evaluation and Litigation Support, Manufacturing Facility, Monmouth Junction, New Jersey. Retained by the New Jersey State Attorney General's Office to determine the extent of groundwater contamination at a former manufacturing facility site subject to ongoing remediation for hydrocarbons, chlorinated VOCs, and VOCs in soil and groundwater. Developed expert opinions regarding the extent of groundwater contamination over time. This case included trial testimony.

- Expert Opinion Development, Wood-Treatment Facility, Seattle, Washington. Retained to develop expert opinions regarding liability and allocation at a large NPL Superfund site that had operated as a wood-treatment facility from 1909 until 1994. Approximately $50 million has been spent on

investigation and cleanup at the site to date. The administrative and litigation processes were divided into an offshore sediment portion and an upland portion. Development of the Expert Report for the offshore sediment portion of the case included review of 15 years of technical documents and depositions, and analysis of sediment contamination to develop an allocation strategy. A similar review was conducted for the upland portion. An Expert Report was prepared for both portions of the case.

- Litigation Support and RI/FS Observation, Former Wood-Treatment Facility, St. Maries, Idaho. Retained by the attorneys of a former owner of a dismantled wood-treatment facility operating as a butt treatment plant that used creosote to treat utility poles. Treatment plant operations resulted in contamination of soil, groundwater, and river sediments. Provided technical review of the administrative (RI/FS) process, and expert work for the litigation process. Technical observation of the RI/FS process involved review of all technical documents generated for this EPA Region 10 lead site. Technical issues involved the creosote free-product migration pathway, the source and timing of creosote discharge to the adjacent river, the extent of sediment contamination, and the appropriate approach to site remediation.

  The litigation process involved cost allocation issues with the current property owner and claims against insurance policies. Allocation issues included the time period and method of the release of creosote, migration of creosote in the subsurface, standard of care issues, compliance with the NCP, and historical changes in site conditions that resulted in increased investigation and remediation costs. Support of the litigation process included conducting a comprehensive assessment of soil, groundwater, free product, and sediment data. Data, including radioisotopes in sediments, were collected for litigation purposes. The analysis resulted in preparation of two Expert Reports and a Rebuttal Expert Report. Was deposed in this case, which subsequently was settled.

- Expert Opinion Development, Manufacturing Facility, Long Beach, California. Retained by DOJ attorney to develop opinions related to consistency with the NCP for a former aerospace manufacturing facility. The analysis included review of documents and costs for $150 million of investigation and remediation costs. Contaminants at this large manufacturing facility included chlorinated solvents, hydrocarbons and metals. Determined that a large portion of the investigation and remediation work performed under oversight of the California State Water Resources Control Board was not consistent with the NCP.

- Rebuttal Opinion Development, Former Mine, Washington. Retained to develop rebuttal opinions regarding a former mine in northeast Washington. Issues related to attributing waste generation among several operators of the mine and allocating costs for remediation of the waste areas.

- Source Identification and Cost-Recovery Support, Suburban Neighborhood, Pleasant Hill, California. Retained to determine the source of groundwater contamination impacting homes in a suburban neighborhood. Contaminants included hydrocarbons, methyl tertiary-butyl ether, and chlorinated VOCs. Cost-recovery action included development of expert opinions regarding the source of contamination, and liability allocation.

- Expert Report Development, Landfill, Sayreville, New Jersey. Retained to develop expert opinions regarding the source and extent of groundwater contamination at a solid waste landfill. Examined historical waste practices and evaluated the implemented remediation at the landfill. Developed estimates of the volume of impacted groundwater over time to support a claim of natural resource damages. The primary contaminants were chlorinated solvents.

- Expert Report Development, Gas Station, San Diego, California. Developed an Expert Report regarding the source and the fate and transport of gasoline additives at an active remediation site. Contaminants

included hydrocarbons and methyl tertiary-butyl ether. Issues involved the appearance of gasoline additives in cross-gradient monitoring wells and identifying the responsible parties.

REMEDIAL INVESTIGATION/FEASIBILITY STUDY AND REMEDIATION

- Investigation, Industrial Dry Cleaning Facility, Minneapolis, Minnesota. Directed an investigation of a release of PCE at this operating dry cleaning facility under a Voluntary Investigation and Cleanup Program. Conducted a soil gas survey using Geoprobe equipment, and placed soil borings and monitoring wells based on the Geoprobe data. Mapped the extent of impact from PCE in soil and groundwater.

- RI, Manufacturing Facility, Sacramento, California. Conducted an RI of soil and groundwater contamination by VOCs associated with historical chlorinated solvent releases at this manufacturing facility. A complex groundwater flow system and plume were analyzed. Developed a remediation approach for the impacts that was approved by the State regulatory agency.

- RI and Remediation, Industrial Dry Cleaner, Minneapolis, Minnesota. Retained by attorneys to conduct an RI and remediation of a release of PCE at this industrial dry cleaner facility. The RI identified the source of the release, and the extent of the impact in soil, the vadose zone, and groundwater. Developed a remediation approach that was approved by the State environmental regulatory agency.

- RI/FS and Remediation, Solvent Disposal Site, Cokato, Minnesota. Conducted an RI/FS and remediation at this solvent disposal site. The RI involved characterization of source areas, the level and extent of soil impact, and the extent of groundwater impact of release in underlying fractured till. Demonstrated that the groundwater impact did not require active remediation, and that off-site private wells would not become impacted in the future. Soil impact was accurately characterized, and a remediation approach involving excavation and on-site low-temperature thermal treatment was developed. Successfully remediated soil and received a closure letter from the State environmental agency. Technical Review, Solvent Distribution Facility, Indiana. Provided technical review of a Resource Conservation and Recovery Act Facility Investigation (RFI) at this solvent distribution manufacturing facility. An RFI had been imposed that involved 12 solid waste management units, including current and past waste-handling areas. Project work involved characterization of the groundwater plume that developed from the solid waste management units. A technical case that combined geochemical data and modeling was successfully presented to EPA for natural attenuation of the plume.

- RI/FS, Solvent Distribution Facility, Minneapolis, Minnesota. Retained by attorneys to perform an RI/FS for this active solvent distribution facility. The work involved investigation of historical source areas and the level and extent of soil and groundwater impacted by chlorinated solvents, and negotiations with the State regulatory agency. Based on this work, a remedial approach was developed and implemented for the site.

- Investigation, Solvent Distribution Facility, Minneapolis, Minnesota. Retained by outside counsel to conduct an investigation at this solvent distribution facility. Project work included identification of historical source

areas and the level and extent of soil and groundwater impact, determination of the presence of the chlorinated solvent dense nonaqueous-phase liquid (DNAPL) and the contribution of off-site sources, and development of a remediation approach. Negotiated a successful resolution with the State environmental agency.

- Remedial Investigation, Former Solvent Distribution Facility, Omaha, Nebraska. Conducted an RI for soil and groundwater contamination by chlorinated solvents at this former solvent distribution facility site characterized by a complex groundwater flow system. Technical issues included determining source areas and delineating the contribution from and responsibility of an adjoining property. The investigation identified historical source areas and demonstrated that the adjoining property was a contributing factor to existing groundwater contamination.

- Technical Observation, State Superfund Landfill, Bemidji, Minnesota. Provided observation for the characterization of the plume at this closed landfill. A large municipal water supply well-field potentially was impacted by the plume from the site. Analytic element groundwater modeling was used to assess the potential impact of the plume on the well-field. Developed recommendations for pumping from the well-field to protect water quality. Also evaluated remedial alternatives for associated groundwater contamination from the landfill.

- Hydrogeologic Investigation, Solid Waste Landfill, Elk River, Minnesota. Conducted a hydrogeologic investigation at this active solid waste landfill when groundwater monitoring limits were exceeded. Additional monitoring wells were constructed, and an analysis of the local groundwater flow system and the fate and transport of detected compounds was performed. Elevated levels of contaminants were detected at several up-gradient wells. An analysis of the impacts of soil gas on concentrations of VOCs detected in monitoring wells showed that the impacts were not caused by releases from the landfill.

- Remediation Approach Reassessment, Former Wood-Treatment Facility, Salisbury, Maryland. Performed a critical reassessment of the remediation approach for this 200-plus-acre former wood-treatment facility site that was used to pressure-treat utility poles with creosote. A large area of impacted groundwater was present at the site, with approximately 1 to 2 million gallons of creosote present on a clay confining layer. An FS featuring a large pump and treat system previously had been approved by the State environmental agency. After an extensive cost analysis, the client established a new remediation goal for the site that involved no extraction or treatment of groundwater, and minimal long-term operation and maintenance. Developed a containment approach that included a 6,100-foot-long, 60-foot-deep cement bentonite slurry wall. A hydraulic gate was designed on the down- gradient side of the barrier to handle the release of water from the enclosed area. Decision analysis was used in the design of the barrier to account for difficult geotechnical conditions at the site. Groundwater modeling showed that careful management of the water balance for the site would make pumping and treatment unnecessary. Conducted negotiations with the State that resulted in acceptance of this new approach. Remediation also included limited DNAPL extraction, construction of both tidal and non-tidal wetlands, phytoremediation, rerouting of an impacted stream, and air sparging down-gradient of the hydraulic gate. The completed project received a State award for Environmental Excellence.

- Investigation and Remediation, Foundry and Electroplating Sites, Ontario, Canada. Conducted an investigation and remediation at two heavy-metal foundry and electroplating plant sites where extensive soil contamination by lead, arsenic, copper, and zinc was discovered. A hydrogeologic and geochemical characterization of these sites demonstrated that the limited groundwater impact was not a risk. Impacted soil at both sites was mixed with concrete and retained on site.

- RI/FS, Active Landfill, Inver Grove Heights, Minnesota. Directed the completion of an RI and the development of an FS for this active NPL landfill. The key technical concern was chlorinated hydrocarbons in a 100-foot-thick unsaturated zone and in the underlying unconfined aquifer. Renegotiated the Consent Order with the State agency to provide a suitable mechanism to complete the RI and proceed with remediation. Extensive monitoring of bedrock aquifers was required to develop a suitable understanding of the extent of impacted groundwater and develop a remediation approach. The use of flow modeling in the RI of bedrock aquifers resulted in considerable cost savings to the client. An in-situ bioremediation approach was developed in the FS.

- Technical Review and Conceptual Design, Active Wood-Treatment Site, South Carolina. Conducted a technical review of a Corrective Measures Study (CMS) for an active wood-treatment site that involved soil and groundwater impacts by PAHs, pentachlorophenol, dioxin, and metals, where DNAPL also is present. The CMS recommended physical containment of the DNAPL area, and retention of an existing groundwater extraction system. The CMS was structured to allow the client to conduct future evaluation of the feasibility of bioremediation to replace the groundwater extraction system. Developed a conceptual design for a physical barrier system. Used groundwater modeling to examine barrier configurations and the hydraulic responses of various designs. Based on the modeling, selected an open barrier configuration, and designed a water-level monitoring system.

- Technical Review, Defense Contractor NPL Site, Denver, Colorado. Conducted an extensive technical review of groundwater impact by chlorinated solvents at this Defense Contractor NPL site, triggered by a 5-year review process. Based on the review and analysis of the effectiveness of the groundwater remediation system, changes in the system resulted in concurrence by the State agency that the system was meeting remedial goals.

- Technical Review and Expert Witness Support, Manufacturing Facility, Red Wing, Minnesota. Retained by an attorney to provide technical review and expert witness support for insurance litigation at this State Superfund site with VOC-contaminated groundwater. Issues involved interpretation of groundwater flow, fate and transport of chlorinated solvents, and timing of releases.

- Remedial Investigation, Former Warehouse and Truck Maintenance Facility, Fairfield, California. Conducted an RI for soil and groundwater contamination by hydrocarbons and chlorinated solvents at this former warehouse and truck maintenance facility. Worked with the local regulatory agency to obtain a closure letter for this Site.

- Phase I and II Environmental Assessments, Manufacturing Facility, Bakersfield, California. Performed an Environmental Assessment, including sample collection, for the buyer of this manufacturing facility. Conducted a Phase II Assessment that included collection and analysis of soil and groundwater samples with a gas chromatograph-equipped Geoprobe.

- Remediation System Technical Observation, Former Industrial Disposal Site, Plumstead Township, New Jersey. Retained to assume responsibility for technical observation of an existing remediation system that was not meeting remedial goals for chlorinated and nonchlorinated VOCs. EPA requested major changes and additions to the existing system, including a fully enclosed physical barrier keyed into a semi-confining layer, a pump-out and treatment system, and re-injection of treated water. EPA also questioned the integrity of the aquifer underlying the semi-confining layer. Performed an extensive analysis of system hydraulics and satisfied EPA that the system was working properly after minor adjustments, and that the underlying aquifer was protected. Numerous technical issues regarding system performance were raised by EPA. Through a series of technical analyses and meetings with EPA, showed that the system was meeting remedial goals. Analyzed numerous changes to the existing system to improve performance and reduce operating costs.

- Investigation and Assessment, Major Landfill, Phoenix, Arizona. Oversaw the initial investigation and assessment of a sizeable landfill to place the site on the original NPL. Worked with the State of Arizona in the compilation and analysis of available information on the history of and impacts created by this landfill, which was adjacent to a major intermittent-flowing river. The impacts associated with the landfill included a significant groundwater plume, methane impacts, and impacts on the river resulting from the washing away of portions of the landfill during major flow events.

- Remedial Investigation, Brine Injection Wells, Bakersfield, California. Conducted an RI to determine the impact of brine injection wells on groundwater. The RI included an examination of well construction and maintenance records, brine injection history, regulatory compliance, groundwater quality, and well integrity.

- Expert Technical Observation, Former Wood-Treatment Facility, Houston, Texas. Provided expert technical observation on groundwater issues at this former creosote plant. Observation involved an extensive review of geologic, hydrogeologic, water quality, and DNAPL data. Data interpretation was complicated by the presence of fractured bedrock near the surface.

- RI and Cleanup Action, Multiple Service Stations, Various Minnesota Locations. Managed the investigation and cleanup action at approximately 10 retail service station sites for a major oil company. The work included environmental observation of tank excavations, observation of impacted soil excavation and treatment, RI of soil and groundwater, remedial alternative selection, and observation of remediation system design and implementation.

- RI and Cleanup, Multiple Service Station and Bulk Fuel Sites, Various Minnesota Sites. Managed investigation and cleanup projects at several retail service stations under contract to the State

environmental agency. Project work involved preparing investigation work plans, directing field work and report preparation, interpreting data, recommending corrective actions, and overseeing corrective action design and implementation. Participated in public meetings and negotiations with Responsible Parties.

- Environmental Observation, Telephone Switching Stations, Four-State Area. Managed the environmental observation of tank excavations at approximately 15 telephone switching stations across four states. One diesel fuel tank used as a fuel supply typically was present at each switching station. Project work involved observation of the tank-excavating contractor, field-screening of excavated soil for hydrocarbons, observation of impacted soil removal, and coordination of removal and treatment of impacted soil. Performed additional investigation and remediation activities as needed.

- Investigation and Cleanup, Former Gasoline Station, Royalton, Minnesota. Directed an investigation and remediation of an underground storage tank site in the Minnesota Voluntary Investigation and Cleanup Program. A former gasoline station was present on the site of a major property development. Leaking underground tanks at the site were removed, and soil and groundwater remediation was conducted.

- RI, Oil Refinery, Rosemount, Minnesota. Retained by attorneys to conduct an RI of a release from the main refinery and tank farm at this property. The State environmental agency requested an unreasonable level of soil cleanup at the refinery, based on a leaching model. Successfully negotiated reasonable cleanup levels based on an independent analysis of the relationship between soil concentrations and groundwater conditions.

- Site Characterization, Nuclear Waste Repository, Hanford, Washington. Conducted a review and provided critical assessment of numerous documents characterizing groundwater flow conditions and the fate and transport of contaminants in a fractured bedrock system. The site was being characterized for development of an underground nuclear waste repository.

- Investigation and FS, Former Steel Plant, Duluth, Minnesota. Conducted an extensive investigation and performed an FS at a large closed steel plant on the NPL. The project involved complete characterization of waste disposal areas at the site, and the impact from each identified area. Soil and groundwater impacts were evaluated, including groundwater flow in a clay system. The primary compounds of concern were PAHs from coal tar from the plant's coke batteries. The coal tar and associated impacted material were present in deposits 15 feet deep in a ravine adjacent to the plant, where extensive coal tar deposits were identified. The FS included identification of and remedial alternative selection for approximately 14 operable units. A comprehensive remediation approach for these operable units was approved by the State environmental agency.

- RI, Active Rail Yard, Superior, Wisconsin. Conducted an RI of soil and groundwater impacts from historical releases at an active rail yard and locomotive repair facility site impacted by fuel products and solvents

from past operations. The RI included identification and characterization of historical source areas, and characterization of the impact on underlying aquifers.

- Investigation, Former Coal Gasification Plant, Des Moines, Iowa. Conducted an investigation of a former coal gasification plant located adjacent to a major river. EPA Region 7 was directing the investigation and cleanup of this Superfund site. Determined the extent of soil, groundwater, and sediment contamination.

- RI/FS and Remediation, Former Coal Gasification Plant, Fairbault, Minnesota. Conducted an RI/FS and remediation of soil and groundwater contamination resulting from coal tar wastes at this state Superfund site. Technical issues included determining historical sources, the level and extent of soil and groundwater impacts, the impact of groundwater discharge to the adjacent river, sediment contamination, and the impact of the site on municipal water supply wells. Conducted an analysis of hydrogeological information and used the results to determine that the hydraulic relationship between the site and the municipal water supply wells did not present a problem. Remediation selection negotiations with the State environmental agency resulted in removal of surficial coal tar, and No Action on impacted soil and groundwater based on risk analysis.

- FS and Remediation, Former Wood-Treatment Facility, Cass Lake, Minnesota. Conducted an FS for impacted groundwater at this NPL site, a former wood-treatment facility that used creosote and pentachlorophenol for approximately 50 years. Determined the most cost-effective groundwater remediation alternative for two separate locations. Designed two groundwater pump-out systems and a central carbon treatment system. As part of the hydraulic design of the pump-out systems, performed a modeling study to analyze the capture zone for different well configurations to minimize flow rates. Developed and implemented an approach to verify the capture zones in the field after system start-up. Developed portions of the plans and specifications and oversaw construction and operation systems.

- Environmental Management, Starch Manufacturing Facility, Cedar Rapids, Iowa. Retained by attorneys to manage several environmental investigation/remediation projects and environmental initiatives for a specialty starch manufacturing facility. The work involved several RI/FS projects, management of the facility's supply well system, including reconstruction of a 1500-foot-deep well, development of a comprehensive environmental management program, collaboration with plant environmental staff on compliance issues, and assisting with plant expansion through property purchases. The main supply well for the facility was impacted with benzene and ethylbenzene, which an extensive analysis showed had an off-site source. The well was photo-logged to determine an appropriate redesign effort to enable the plant to maintain operations. A sleeve was placed and secured in the existing well to restrict water in the impacted aquifer from entering the supply well.

  The largest RI/FS project involved soil and groundwater contamination by PAH compounds from heavy fuel oils. A risk assessment was performed to support the recommendations of the FS.

Based on the risk assessment, a remediation approach was developed that called for soil remediation only if site construction activities required contaminated soil removal.

- Expert Review and Technical Support, Former Wood-Treatment Facility, Charleston, South Carolina. Provided expert review and technical support for a natural attenuation remedy at this former creosote wood-treatment facility. EPA Region 4 previously approved a remedy for remediation of creosote and impacted groundwater. Project work included negotiating with EPA to allow a natural attenuation remedy. Made an extensive technical case to show that natural attenuation would meet remedial goals. The result of this work was a change in the Record of Decision for the site.

- RI, Former Wood-Treatment Facility, Crystal, Minnesota. Retained by attorneys to conduct an RI of this former creosote wood-treatment facility. The investigation included delineating the extent of impacted soil, impacted groundwater, and creosote DNAPL. Through the installation of a series of soil borings, DNAPL was found to be pooled in a geologic low below the water table at a depth of approximately 60 feet below ground surface.

- Investigation, Wood Products Facility, Long Prairie, Minnesota. Conducted an investigation of a former butt treatment operation at this wood products facility. The investigation identified the previously unknown location of the facility, and the extent of soil and groundwater impacts.

- Technical Observation, Former Wood-Treatment Facility, Youngstown, Ohio. Provided technical observation for the investigation and assessment work performed by another consultant at a former wood-treatment facility impacted by PAHs and creosote DNAPL. The observation work resulted in an improved investigation and approach to the FS process.

- Soil and Groundwater Investigation, Tape Manufacturing Facility, Illinois. Directed an investigation of soil and groundwater conditions at a tape manufacturing facility in the vicinity of a solvent tank farm. The work was conducted under a Voluntary Cleanup Program. The critical element at the site was establishing appropriate cleanup levels, which were successfully negotiated with the State regulatory agency.

- Hydrological Analysis and Remediation, Manufacturing Facility, Illinois. An extensive plume developed from discharges from this active manufacturing facility to an on-site lagoon. Conducted a hydrological analysis of the groundwater plume and developed a remedial approach for groundwater contamination based on the results from the analysis. Also designed and provided observation for construction of a new high-capacity production well for the facility.

- Investigation and Analysis, Manufacturing Facility, Wisconsin. Conducted a hydrological investigation and analysis of an extensive groundwater plume. The plume was impacting several aquifers, and the water supply wells of local residents.

- Investigation and Analysis, Food Manufacturer, Wisconsin. Retained by attorneys to investigate a release from wastewater ponds that resulted in elevated concentrations of nitrate in groundwater. Performed geochemical and hydrological analyses to identify the level of risk associated with the release.

- Hydrological Analysis, Operating Manufacturing Facility, Illinois. Performed a hydrological analysis of an existing groundwater pump-out system that was not operating properly. The system consisted of three trenches where groundwater was removed from a central sump in each trench. Used chemical and hydrological information along with groundwater flow modeling to modify and optimize system operation, resulting in substantial cost savings. Conducted investigations of the impact of the site on an underlying bedrock unit and down-gradient receptors. Based on the analysis performed, these receptors were determined to be protected by the remediation system.

- Phase I and II Investigations, Sports Center, Blaine, Minnesota. Conducted a Phase I and a Phase II Investigation of a property that was being acquired to expand this sports center facility. Analysis of the information resulted in a successful acquisition. Remediation of soil contamination was conducted prior to use of the property.

- RI/FS, Manufacturing Facility, St. Paul, Minnesota. Conducted an RI/FS for a chlorinated solvent release at a manufacturing facility. Completed the characterization of the release and negotiated a cleanup strategy with the State regulatory agency.

- RI, Circuit Board Manufacturing Facility, Plymouth, Minnesota. Retained by attorneys to conduct an RI of a release from a circuit board production line. Convinced the State regulatory agency that the impact of the release was small, and that the release could not migrate. Received a No Further Action letter for the client.

- Investigation, Former Automotive Manufacturing Facility, Ironwood, Michigan. Directed an investigation at a wood by-product-recovery facility involving groundwater contamination by coal tar derivatives. Soil and groundwater had been impacted by PAH compounds from facility operations. Methane generated from impacted soil and groundwater accumulated in residential basements, creating significant safety issues. The groundwater impact from a waste disposal area was characterized.

- Investigation and Remediation, Manufacturing Facility, Brooklyn Center, Minnesota. Conducted an investigation and developed a remediation strategy for an abandoned manufacturing facility. Soil and groundwater had been impacted by historical discharges of solvents to a septic system. The groundwater impact created by these historical releases was characterized. A remediation approach was developed that included future redevelopment of the site.

- Transport Modeling, Manufacturing Facility, Minnesota. Releases of PAH compounds from unlined waste lagoons at this facility created the potential to impact the underlying aquifer. Simulated the transport of PAH compounds in the vadose zone under the waste lagoons. Developed a transport

model using a combination of site-specific and literature values to simulate the migration of PAH compounds in the thick unsaturated zone underlying the site. A transport model was developed to simulate the migration of the PAH compounds in the thick unsaturated zone underlying the site. A combination of site-specific values and literature values were used in the model. The results showed that the underlying aquifer would not be impacted above regulatory levels.

- Hydrogeologic Investigation and Analysis, Open Pit Mine Development, Montana. Performed a comprehensive hydrogeologic investigation and analysis at an open pit mine development. The assessment was in support of permit applications required for the development.

Presentations and Publications

Publications

Frind, E.O., and G.E. Hokkanen. 1987. "Stimulation of the Borden Plume Using the Alternating Direction Galerkin Technique." *Water Resources Research*. 23 (no. 5): 918-930.

Hokkanen, G.E. 1984. *Application of the Alternating Direction Galerkin Technique to the Simulation of Contaminant Transport at the Borden Landfill.* Master of Science Thesis, Department of Earth Sciences, University of Waterloo.

———. 2006. "DNAPL Sites – The Technical and Legal Challenges." *ABA Superfund and Natural Resources Damages Litigation Committee Newsletter*. 3 (no. 1).

Presentations

"Dry Cleaner Claims and Questions About Cities and Their Sewers." 2015 Environmental and Emerging Claim Manager Conference. 2015.